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San Joaquin River Hydrologic Region Summary

Section is under development.

Current State of the Region

Setting

In the San Joaquin River Hydrologic Region, one in three residents, almost $42 billion worth of assets (crops, buildings, and public infrastructure), more than 875,000 acres of agricultural land, and over 260 sensitive species are exposed to the 500-year flood event. In San Joaquin County, two out of three residents and almost $1 billion in crop value are exposed to the 500-year flood event. The complexity of existing flood management infrastructure and responsibilities requires balancing agriculture, species, water supply, and flood management needs.

Major floods occur regularly in the San Joaquin River Hydrologic Region. The more damaging floods are usually caused by spring snowmelt. The flatness of the valley floor contributes to the areal extent of these floods. Flooding in the mountainous upper watersheds is rarer due to well developed watercourses, but might still occur, especially in intermontane valleys. These floods take a variety of forms and can be classified into six categories (slow-rise, flash, stormwater, debris flow, alluvial fan, and engineered structure failure flooding).

The San Joaquin River Hydrologic Region is in California's Great Central Valley and is generally the northern portion of the San Joaquin Valley. The region is southerly of the Sacramento River Hydrologic Region and northerly of the Tulare Lake Hydrologic Region (Figure SJR-1 San Joaquin River Hydrologic Region). The region includes approximately half of the Sacramento-San Joaquin River Delta (the Delta)—those areas that are in Contra Costa, Alameda, and San Joaquin counties. The region also contains portions of the following counties: Alpine, Amador, Benito, El Dorado, Fresno, Sacramento, and San Joaquin; and all of Calaveras, Madera, Mariposa, Merced, Stanislaus, and Tuolumne counties.

PLACEHOLDER Figure SJR-1 San Joaquin River Hydrologic Region

[Any draft tables, figures, and boxes that accompany this text for the public review draft are included at the end of the report.]

The hydrologic region is bordered on the east by the Sierra Nevada and on the west by the coastal mountains of the Diablo Range. It includes all of the San Joaquin River drainage area extending south from the southern boundaries of the Delta to include the headwaters of the San Joaquin River in Madera County and its southern drainage in Fresno County. The region is hydrologically separated from the Tulare Lake Hydrologic Region by a low broad ridge that extends across the San Joaquin Valley between the San Joaquin and Kings rivers.

At roughly 300 miles long, the San Joaquin River is one of the state's longest rivers. It has an average annual unimpaired runoff of approximately 1.8 million acre-feet, and its eight major tributaries drain about 32,000 square miles of watershed. The headwaters of the San Joaquin River begin near the 14,000-foot crest of the Sierra Nevada. The river flows from the western slope of the Sierra Nevada and turns northwestward on the San Joaquin Valley floor toward the Delta where it meets the Sacramento River. The two rivers converge in the Delta, which encompasses an area of more than 1,300 square miles. The Delta is a series of islands formed by a maze of channels receiving freshwater inflow from its major tributaries, smaller streams, and the Cosumnes, Mokelumne, and Calaveras rivers. Historically, more than 40 percent of the state's annual runoff flows to the Delta via the Sacramento, San Joaquin, and Mokelumne rivers. (See more information in the Sacramento-San Joaquin Delta Region report of Volume 2).

Watersheds

The San Joaquin River is the principal river of the region, and all other streams of the region are tributary to it. The Mokelumne River and its tributary the Cosumnes River originate in the central Sierra Nevada, along with the more southerly Stanislaus and Tuolumne rivers. The Merced River flows from the south central Sierra Nevada and enters the San Joaquin near the City of Newman. The Chowchilla and Fresno rivers also originate in the Sierra south of the Merced River and trend westward toward the San Joaquin River. Creeks originating in the Coast Range and draining eastward into the San Joaquin River include Del Puerto Creek, Orestimba Creek, and Panoche Creek. Del Puerto Creek enters the San Joaquin near the City of Patterson, and Orestimba Creek enters north of the City of Newman. During flood years, Panoche Creek may enter the San Joaquin River or the Fresno Slough near the town of Mendota. The Kings River is a stream of the Tulare Lake Hydrologic Region, but in flood years it may contribute to the San Joaquin River, flowing northward through the James Bypass and Fresno Slough to enter near the City of Mendota. The Mud, Salt, Berrenda, and Ash sloughs also add to the San Joaquin River, and numerous lesser streams and creeks also enter the system, originating in both the Sierra Nevada and the Coast Range. The entire San Joaquin river system drains northwesterly through the Delta to Suisun Bay.

Groundwater Aquifers

Section is under development.

Ecosystems

Government and privately held forested lands in the Sierra Nevada consist of pine, mixed conifer, and fir forests. The Sierra foothills and rangelands consist of chaparral communities, oak woodlands, riparian habitat, and grass savannas. These areas have been significantly influenced by rural inhabitation and livestock grazing. Riparian habitats exist along rivers, streams, lakes, and ponds.

The Diablo Range contains oak woodlands, grasslands, and chaparral (shrub and brush) communities. Much of these areas have also been used for livestock grazing.

The San Joaquin Valley floor is mostly developed for agricultural production, but has pockets of expanding urbanized areas. Riparian areas exist in the Delta and along rivers, streams, ditches and canals, sloughs, and flood channels. Wetlands are primarily located in private waterfowl hunting areas and government-managed refuges and wildlife areas. Vernal pools are found primarily along the edges of the valley.

According to the Grasslands Water District in Merced County, only 5 percent of the Central Valley's historical 4 million acres of wetlands exist today. Habitat also includes riparian forests, native grasslands, and vernal pools. The remaining wetlands in the Central Valley must be intensively managed to support waterfowl populations that depend on the Central Valley for wintering habitat. The Central Valley Project Improvement Act Section 3406(d) (Refuge Water Supply) establishes the primary goal of providing a firm water supply for wildlife refuges. This firm water supply has helped to create new wetlands and enhance existing wetlands, resulting in increases in populations of federal- and State-listed species—particularly avian species—and other wildlife species such as the giant garter snake (Thamnophis gigas). The firm water supply has helped to reduce the concentration of salts and other contaminants, thereby improving water quality on the refuges and the quality of water discharged from the refuges.

PLACEHOLDER Table SJR-1 Critical Species in the San Joaquin River Hydrologic Region

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Table SJR-1 shows critical species in the San Joaquin River Region. Table SJR-2 shows critical plant species that are endemic to the San Joaquin River region.

PLACEHOLDER Table SJR-2 Critical Plant Species Endemic to the San Joaquin River Hydrologic Region

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Flood

Common types of floods in the San Joaquin River Hydrologic Region include stormwater, slow-rise, and flash flooding. Floods in the San Joaquin Valley originate principally from melting of the Sierra snowpack and from rainfall. Flooding from snowmelt typically occurs in the spring and has a lengthy runoff period. Flooding from rainfall occurs in the winter and early spring.

Major floods occur regularly in the San Joaquin River Hydrologic Region. The more damaging floods are usually caused by spring snowmelt. The flatness of the valley floor contributes to the areal extent of these floods. Flooding in the mountainous upper watersheds is rarer due to well developed watercourses, but might still occur, especially in intermontane valleys. These floods take a variety of forms and can be classified into six categories (slow-rise, flash, stormwater, debris flow, alluvial fan, and engineered structure failure flooding).

Historic Floods

Floods have been recorded in the San Joaquin Valley for more than 175 years. Most notable in the nineteenth century was the “Great Flood” of 1861-1862. Central Valley floods of 1907 and 1909 revised flood management plans of the time and led to development of the San Joaquin River flood management system. The San Joaquin River Hydrologic Region experiences some urban and small-stream flooding in every large storm. The “Great Flood” of 1861-1862 inundated large areas of the West Coast states “from Canada to Mexico.”

In December 1955 through January 1956 heavy rainfall and snowmelt occurred in the upper watersheds of the east-side tributaries to the San Joaquin River. This caused extensive flooding along the river and all its major east-side tributaries, as well as flooding on the larger west-side tributaries. This flood caused extensive damage to agriculture, homes, and public facilities. Thousands of people were evacuated from their homes during the Christmas holiday season, and several people died of heart attacks during the flood. Unusually high tides aggravated the situation by impeding the passage of floodwater through the Delta.

In January 1997, 14 levee breaches occurred on the San Joaquin River between Fresno and the Chowchilla Bypass, inundating agricultural lands that included many vineyards north of the river. The San Joaquin River also flooded a mobile home park in Madera County and damaged the bridge on State Highway 145. There was extensive damage in Yosemite Valley from Merced River overflow. Yosemite National Park was closed, and highways in the region sustained damage. Multiple levee breaches occurred on the San Joaquin River near Vernalis, flooding agricultural lands.

For a complete record of floods, refer to the California Flood Future Report Attachment C: Flood History of California Technical Memorandum.

Climate

The Coast Range mountains isolate the San Joaquin Valley from the coastal California marine effects. Although coastal temperatures often are mild in the summer, the maximum average daily temperature in the valley reaches a high of 101 degrees in late July. Daily temperatures during the warmest months range between 76 and 115 degrees Fahrenheit. The northern part of the San Joaquin River region benefits from Delta breezes during hot summers, leading to evening cooling that does not reliably occur in the southern portion of this region.

Winter temperatures on the valley floor are usually mild, but drop below freezing during occasional cold spells. Frost occurs in most fall/winter seasons, typically between late November and early March. This region experiences a wide range of precipitation that varies from low rainfall amounts on the valley floor to extensive snowfall in the higher elevations of the Sierra Nevada. The snow that remains after winter serves as stored water before it melts in the spring and summer. The average annual precipitation of several Sierra Nevada stations is about 35 inches. Snowmelt from the mountains is a major contributor to local eastern San Joaquin Valley water supplies. The San Joaquin River and storage at Lake Millerton provide water for the Friant Unit of the federal Central Valley Project (CVP).

The upland climate on the west side of the valley resembles that of the eastern Sierra Nevada foothills: long, hot, and often dry summers with mild winters. In the winter, tule fog occurs in the region’s southern portion more often than in its northern portion. Average annual precipitation ranges from about 22 inches near Stockton in the north to about 11 inches in the southern portion; it decreases to about 6.5 inches near the drier southwestern corner of the region.

Demographics

Population

The estimated population of the San Joaquin River Hydrologic Region was approximately 2.1 million people in 2010, according to the U.S. Census Bureau. Approximately 5 percent of the state’s total population lives in this region, and 70 percent of the region’s population lives in incorporated cities. Between 2005 and 2010, the region grew by about 105,200 people, a growth of about 5 percent over the

5-year period. Table SJR-3 shows San Joaquin River Hydrologic region population by county for 2005 and 2010.

PLACEHOLDER Table SJR-3 San Joaquin River Hydrologic Region Population by County for 2005 and 2010

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The most populous city in the San Joaquin River Hydrologic Region is Stockton, with a 2010 estimated population of 291,707. Table SJR-4 lists the top 10 most populous cities within the San Joaquin River Hydrologic Region. These cities account for about half of the population of the entire region.

PLACEHOLDER Table SJR-4 Top 10 Most Populous Cities within the San Joaquin River Hydrologic Region

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Tribal Communities

Table SJR-5 shows the federally recognized Tribes in the San Joaquin River Hydrologic Region.

PLACEHOLDER Table SJR-5 Federally Recognized Tribes in the San Joaquin River Hydrologic Region

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Federal Clean Water Act (CWA) Programs and Tribes

Under the Clean Water Act, the US Environmental Protection Agency (US EPA) administers programs that support federally recognized tribes to address nonpoint source (NPS) pollution, water pollution control programs, and watershed based planning efforts. Because of unique and extremely complex historical circumstances, there are a large number of non-recognized tribes in California, including terminated tribes that may be seeking restoration or recognition by the United States. Tribal existence and identity do not depend on federal recognition or acknowledgement of a tribe. However, in order to be eligible for CWA programs, a tribe must be federally recognized, along with additional requirements. One of the requirements is receiving treatment as a state (TAS) authorization pursuant to §518(e) of the CWA.

Section 319 of the CWA authorizes federal grants to states and tribes in order to implement approved programs and on-the-ground projects to reduce nonpoint source pollutions problems. In the San Joaquin River Hydrologic Region, there are four tribes with TAS status and are eligible for Section 319 program funding: Big Sandy Rancheria of Mono Indians; Picayune Rancheria of Chukchansi Indians; Shingle Springs Band of Miwok Indians; and Table Mountain Rancheria.

Section 106 of the CWA authorizes federal grants to assist state and interstate agencies in administering water pollution control programs. Tribes with TAS status can receive Section 106 funding. This program allows tribes to address water quality issues by developing monitoring programs, water quality assessment, standards development, planning, and other activities intended to manage reservation water resources. In the San Joaquin River Hydrologic Region, there are six tribes involved in Section 106 programs and activities: Big Sandy Rancheria of Mono Indians; Buena Vista Rancheria; Picayune Rancheria of Chukchansi Indians; Shingle Springs Band of Miwok Indians; Table Mountain Rancheria; and Tuolumne Band of Me-Wuk Indians .

Table SJR-6 shows Tribes within IRWM regions in the San Joaquin River hydrologic region.

PLACEHOLDER Table SJR-6 Tribes within Integrated Regional Water Management Regions in the San Joaquin River Hydrologic Region

[Any draft tables, figures, and boxes that accompany this text for the public review draft are included at the end of the report.]

Disadvantaged Communities

Disadvantaged Communities are defined as those communities having a Median Household Income (MHI) of 80% of statewide MHI. While the smaller towns, such as Chowchilla, Gustine, and Firebaugh, are mainly rural and engaged in the farming industry, the larger cities, such as Stockton, Merced, and Madera are only about 20% to 30% rural (versus urban); furthermore, the residents of these larger cities are mainly employed in the educational services and healthcare sectors.

Table SJR-7 lists DACs by Cities and their population and MHI within the San Joaquin River Hydrologic Region. Figure SJR-2 displays the MHI for these cities graphically.

PLACEHOLDER Table SJR-7 Disadvantaged Communities (Cities) within the San Joaquin River Hydrologic Region

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PLACEHOLDER Figure SJR-2 Median Household Income (MHI) for Disadvantaged Communities (DACs) within the San Joaquin River Hydrologic Region: Cities

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Another census entity used in the identification of DACs is Census Designated Place (CDP). A CDP is a statistical entity, defined for each decennial census according to Census Bureau guidelines, comprising a densely settled concentration of population that is not within an incorporated place, but is locally identified by a name. Table SJR-8 lists the poorest 20 CDPs (also DACs) within the San Joaquin River Hydrologic Region by population (> 2,000) and MHI. Figure SJR-3 shows these places by MHI.

PLACEHOLDER Table SJR-8 Poorest 20 Census Designated Places within the San Joaquin River Hydrologic Region with Populations Greater than 2,000

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PLACEHOLDER Figure SJR-3 Median Household Income (MHI) for Disadvantaged Communities (DACs) within the San Joaquin River Hydrologic Region: Poorest 20 Census Designated Places

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Land Use Patterns

Agriculture remains the dominant economic sector of the San Joaquin River Hydrologic Region. Agricultural production, processing, packaging, handling, shipping, and the sales of goods and services supporting agriculture represent a major economic and land use activity. Urban development has increased over the last two decades with the significant population growth in cities such as Stockton, Tracy, Manteca, Galt, Lodi, Modesto, Turlock, Merced (UC Merced, which opened in September 2005, has a student population of about 5,800), Los Banos, and Madera, which in turn, has encroached into the surrounding agricultural lands. Pacheco and Altamont passes serve as commuting corridors into the Bay Area and contribute to the growth of valley communities. Nonetheless, vast tracts of productive agricultural land continue to surround these cities.

More people are settling in the Sierra Nevada foothills and mountains, and a greater number of visitors are taking advantage of the area's recreational activities, such as golfing, sightseeing, camping, backpacking, boating, cycling, fishing, and water- and snow-skiing.

The valley portion of the region constitutes about 3.5 million acres, the eastern foothills and mountains total about 5.8 million acres, and the western coastal mountains comprise about 900,000 acres.

The San Joaquin Valley is recognized as one of the most important and productive agricultural areas in the United States. It contains roughly 2 million acres of irrigated cropland with an annual agricultural output valued at more than $ 9.3 billion (from 2010 county agricultural commissioner reports). Figure SJR-4 shows gross agricultural value for the San Joaquin River Hydrologic Region for 2005-2010 by county.

PLACEHOLDER Figure SJR-4 San Joaquin River Hydrologic region Gross Agricultural Value for 2005-2010, in Millions of Dollars

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The San Joaquin River Hydrologic Region has a high diversity of crops with the top five single crop types in acreage being almonds, corn, alfalfa, grapes and processing tomatoes. Although higher in acreage, "other field" and "other deciduous" crops can be assorted types and no single crop is probably greater in acreage than processing tomatoes. Figure SJR-5 shows the top 10 crop types in the San Joaquin River Region by acreage by water year for 2005-2009.

PLACEHOLDER Figure SJR-5 Top 10 Crop Types by Acreage for the San Joaquin River Region for 2005-2009

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In addition to agriculture, other important industries in the region include food processing, chemical production, lumber and wood products, glass, textiles, paper, machinery, fabricated metal products, and variety of other goods.

Although the valley floor is primarily privately owned agricultural land, much of the Sierra Nevada is national forest. Government-owned public lands include the El Dorado, Stanislaus, and Sierra national forests and Yosemite National Park. Public lands amount to about one-third of the region's total land area. The national forest and park lands include more than 2.9 million acres. U.S. Bureau of Land Management and military properties occupy more than 200,000 and 5,100 acres, respectively. State parks, recreational areas, and other State property occupy about 80,000 acres.

Regional Resource Management Conditions

The Merced, Tuolumne, Stanislaus, Calaveras, Mokelumne, and Cosumnes rivers are tributaries of the San Joaquin River and drain the central Sierra Nevada. The lower portions of the watersheds provide runoff from rainfall. The higher elevations of the watersheds supply snowmelt runoff during the late spring and early summer. These tributaries supply significant surface water for local use.

The Chowchilla and Fresno rivers (Madera County) receive water from the lower elevations of the Sierra Nevada foothills. Most of the runoff comes directly from rainfall. Buchanan Dam on the Chowchilla River forms Eastman Lake; Hidden Dam on the Fresno River forms Hensley Lake. The CVP's Friant Unit provides surface water to the southeastern valley floor via the Madera Canal from Lake Millerton, but the largest share of CVP supplies from Lake Millerton is sent to the Friant Water Users Authority in the Tulare Lake Hydrologic Region. Delta waters are brought into the region along the west side of the valley by the State Water Project (SWP) California Aqueduct, and the federal San Luis Unit Project (San Luis Canal) and Delta-Mendota Canal.

Surface water from the Sierra Nevada is of high quality and reasonably dependable. The available water meets roughly half of the local water needs. Imported water adds to the surface water supply; groundwater meets the remainder water use needs. Reductions of imported supplies from drought, legal actions, and other compliance requirements are a concern for local suppliers who seek long-term availability, stability, and reliability of imported supplies. Existing local surface water supplies are also strained by increases in local demand, environmental needs, and water needed for restoration purposes.

Water in the Environment

Restoration of Central Valley wetlands and habitat is critical to the preservation of many species of fish and wildlife in the San Joaquin Valley. Beginning in the 1990s, agencies made progress in their efforts to set aside and restore wetland habitat acreage. In 1990, the San Joaquin River Management Program was formed to restore the river system, which led to completion of the San Joaquin River Management Plan in 1995. The management plan identified nearly 80 consensus-based actions intended to benefit the San Joaquin River system, addressing six problem areas: flood protection, water quality, water supply, wildlife, fisheries, and recreation. These actions are organized into projects, feasibility studies, and riparian habitat acquisitions. Agencies participating in the program included US Fish and Wildlife Service, USBR, USACE, and DWR. An Advisory Council was created that included representatives from counties and cities in the area, water user interests, and wildlife groups. The management program concluded in 2007, and some restoration activities are now managed through the San Joaquin River

Restoration Program.

In 2002, River Partners began a restoration project west of Modesto along the San Joaquin River. Seven hundred and seventy seven acres of Riparian habitat was restored on the West Unit of the San Joaquin River National Wildlife Refuge Since then, 2,350 acres of habitat on the refuge have been restored by River Partners.

The San Joaquin Valley is a major stop on the Pacific Flyway, a north/south pathway along the West Coast for migratory birds. The birds travel between their breeding grounds in the north and their wintering grounds in the south. Within the San Joaquin River Hydrologic Region, wildlife refuges, managed by the US Fish and Wildlife Service, and wildlife areas, managed by the California Department of Fish and Wildlife, include San Luis National Wildlife Refuge, which encompasses 26,600 acres; the San Joaquin River National Wildlife Refuge, 7,000 acres; Merced National Wildlife Refuge, 10,262 acres; Los Banos Wildlife Area, 6,217 acres; Volta Wildlife Area, 2,891 acres; the North Grasslands Wildlife Area, 7,069 acres; the White Slough Wildlife Area, 969 acres; and the Isenberg Sandhill Crane Reserve (managed by CDF&W), 361 acres. The Cosumnes River Preserve in the northern region is managed by the Nature Conservancy. At 46,000 acres, it has become the largest refuge area in the region. The main source of surface water supplies for many of the wildlife refuges within the San Joaquin River region is the Central Valley Project (via CVPIA). Table SJR-9 shows CVP supplies for wildlife refuges in the region.

PLACEHOLDER Table SJR-9 Central Valley Project Supplies for Select Wildlife Refuges in the San Joaquin River Region

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Private hunting clubs and other privately held lands also provide wetland habitat. The Grasslands Resources Conservation District includes about 70,000 acres, of which 36,068 acres are irrigated habitat, encompassing gun and duck clubs in the Grasslands area near Merced. The Grasslands WD provides these clubs with CVP surface water supplies. The Merced NWR receives water via the Merced Irrigation District.

Various rivers and streams with instream flow requirements and Wild and Scenic designations are within the San Joaquin River Hydrologic Region. The Mokelumne, Stanislaus, Tuolumne, Merced and San Joaquin rivers have instream flow requirements. DFG is required by the Public Resources Code (sections 10000-10005) to develop flow recommendations for watercourses and streams throughout the state for which minimum flow levels need to be established in order to assure the continued viability of fish and wildlife resources. These flow recommendations are considered by the State Water Resources Control Board (State Water Board) in regulatory actions related to appropriation of water and other planning activities.

The Tuolumne and Merced rivers also have Wild and Scenic designations. The National Wild and Scenic Rivers System was created by Congress in 1968 to preserve certain rivers with outstanding natural, cultural, and recreational values in a free-flowing condition for the enjoyment of present and future generations. While the designation neither prohibits development nor gives the federal government control over private property, it does prohibit federal support for actions such as the construction of dams or other instream activities that would harm a river's free-flowing condition, water quality, or outstanding resource values. Recreation, agricultural practices, residential development, and other uses may continue. Protection of the river is provided through voluntary stewardship by landowners and river users and through regulation and programs of federal, State, local, or Tribal governments. For more information see: http://www.rivers.gov/rivers/.

Water Supplies

Surface and Groundwater

On the valley floor, many agricultural and municipal users receive water supply from large irrigation districts, such as the Modesto, Merced, Oakdale, South San Joaquin, Madera, and Turlock irrigation districts. Most of this region's imported surface water supplies are delivered by the CVP, which averages about 1.9 million acre-feet per year. In addition, Oak Flat Water District receives about 4,500 acre-feet per year from the SWP. Most of the surface water in the upper San Joaquin River is stored and diverted at Friant Dam and is then conveyed north through the Madera Canal and south through the Friant-Kern Canal. Average annual diversions from the San Joaquin River through the Friant-Kern and Madera canals total about 1.3-million acre-feet per year (260,000 acre-feet per year for the Madera Canal and 1.03 million acre-feet for the Friant-Kern Canal).

The tributaries of the San Joaquin River provide the region with high-quality water that constitutes most of the surface water supplies for local uses. Much of this water is regulated by reservoirs and used on the east side of the San Joaquin Valley.

The availability and use of groundwater is of critical importance in the San Joaquin Valley. Water use requirements are met through a three-pronged supply strategy. Water use is first met by developed local surface water supplies. In areas where insufficient surface water exists, imported surface water is contracted through the SWP and the CVP. Where no surface water is available or where needs can be met by groundwater, local groundwater is pumped. Shortfalls in surface supplies can be made up with groundwater where it is available and of sufficient quality. Figure SJR-6 shows water supplies for the San Joaquin River region for water years 2005-2010. Total supply by source is shown, as well as percent of supply by source for a given year. The figure shows declining surface water supplies and increasing groundwater supplies over time due to the drought of 2007-2009. Total supplies are less during the years leading up to the drought because more rain fell during this time, which required less surface supplies for a given application. For a summary of the regional water inflows and out flows, see Figure SJR-7.

PLACEHOLDER Figure SJR-6 San Joaquin River Hydrologic Region Water Supplies for Water Years 2005-2010

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PLACEHOLDER Figure SJR-7 San Joaquin River Hydrologic Region Inflows and Outflows

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If long-term increases in demand are met with groundwater supplies, subsequent decreases in groundwater levels can be expected. Intensive groundwater pumping can also outstrip the aquifer system's ability to recharge itself. Declining groundwater levels have a direct impact on pumping costs. Increased energy usage is necessary to lift groundwater from greater depths. Declining groundwater levels also reduce pore pressure in the aquifer system. In areas subject to groundwater-related land subsidence, this drop in pressure can result in the land surface lowering. Land subsidence may damage wells and water conveyance facilities such as canals and flood channels. Near Los Banos is a documented major land subsidence area.

Figure SJR-8 shows annual deliveries by the CVP (south of the Delta) and SWP systems by % of contracted amounts for the years 2005-2010. During the drought years of 2007-2009, agricultural surface water supplies were the most severely impacted. Table SJR-10 displays the annual deliveries by percentage of contracted amounts for the years 1998-2010. CVPIA began in 2001, as shown in the table (Wildlife), and has since seen all of their requests for CVP supplies fulfilled.

PLACEHOLDER Figure SJR-8 South of Delta Central Valley Project and State Water Project Annual Deliveries 9Percentage of Contracted Amount)

[Any draft tables, figures, and boxes that accompany this text for the public review draft are included at the end of the report.]

PLACEHOLDER Table SJR-10 South of Delta Central Valley Project and State Water Project Deliveries (Percentage of Contract Amounts)

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Fractured rock wells supply groundwater to much of the self-supplied homes and purveyor-supplied small communities in the Sierra Nevada foothills and mountains. The available supply fluctuates and is vulnerable to even short periods of low precipitation. The fractured rock is also an avenue for septic system biota to rapidly pass through areas of source water supply. Increasing development and growth in the foothills and mountains poses a risk to both supply and health, due to the interconnected nature of rock fractures and fissures.

Federal land reservations for Tribes have an associated reserved federal water right. This federal water right may predate existing State water rights or fall outside the jurisdiction of State water rights law. These federally reserved water rights are not subject to loss due to non-use. As water use increases around these reserved water rights, the potential for conflict also increases. Quantification and timing of these reserved water rights will be keys to resolving conflicts with the other surrounding water rights holders.

In 2006, the North Fork Rancheria of Mono Indians entered into a 20-year memorandum of understanding with Madera Irrigation District. This MOU provides mechanisms to address and offset water-related impacts of rancheria development. Among the issues it covers are aquifer recharge, monitoring water usage, "right to farm," and creation of a water advisory committee.

Recycled Municipal Water

According to the 2009 Municipal Wastewater Recycling Survey, compiled by the State Water Resources

Control Board, 28,888 acre feet per year are being recycled in the San Joaquin Hydrologic Region. Most of the recycled water was used for agricultural irrigation. Some of the recycled water was used for landscape irrigation, industrial uses, commercial uses, natural systems and golf course irrigation. (SWRCB. 2011a). State policy encourages increased use of recycled water but recognizes the potential of recycled water to contribute to exceeding or threatening to exceed water quality objectives due to salt and nutrients (SWRCB. 2009). Therefore, the policy requires stakeholders to work together to develop salt and nutrient management plans.

In the Central Valley, of which the San Joaquin River Hydrologic Region is a part of, the Central Valley Water Board and the State Water Board, as part of a stakeholder effort, are developing a comprehensive salt and nitrate management plan for the Central Valley. The Central Valley Salinity Alternatives for Long-Term Sustainability (CV-SALTS) is a strategic initiative to address problems with salinity and nitrates in the surface waters and ground waters of the Central Valley. The long-term plan developed under CV-SALTS will identify and require discharger implementation of management measures aimed at the reduction and/or control of major sources of salt and nitrate as well as support activities that alleviate known impairments to drinking water supplies. As this issue impacts all users (stakeholders) of water within the San Joaquin Region, it is important that all stakeholders participate in CV-SALTS to be part of the development and have input on the implementation of salt and nitrate management within the San Joaquin River Hydrologic Region. For the Central Valley, the only acceptable process to develop the salt and nutrient management plans that are required under state policy is through CV-SALTS (SWRCB. 2009).

Water Uses

At higher elevations in the Sierra Nevada, reservoirs capture water to produce hydroelectric power. In some locations, a sequence of plants produces power. Some diversions occur for local use. A network of canals, ditches, tunnels, and flumes was constructed in the 1850s for mining and timber purposes. Some of the remnants of those systems remain in use today. As surface water moves closer to the foothills/valley floor, larger reservoirs provide storage for flood control and other purposes, such as power production, diversion, conservation storage, fish and habitat releases, and salinity control. Conservation storage is most often used for urban and agricultural purposes. This lower and larger storage is often operated by or in conjunction with valley irrigation districts that hold water rights and distribute the surface water to their users. Reservoirs and downstream releases also provide recreational opportunities.

Cities in the San Joaquin Valley predominately developed groundwater to supply residents. As a consequence, many of the major population areas experienced groundwater depressions. The stress on the groundwater system and costs, limitations, and uncertainties of treating water at each wellhead has created a gradual movement toward using treated surface water.

Throughout the region, individual and private owners maintain groundwater wells to meet individual needs. In the foothill and mountain areas, groundwater is the primary supply. Well interference problems have resulted from larger-capacity water system wells that are close to other wells and are pumped at relatively high rates for prolonged periods. In other areas, further large-scale dense development may require a supplemental water supply to augment the available groundwater.

Drinking Water

The region has an estimated 438 community drinking water systems. The majority (over 80%) of these community drinking water systems are considered small (serving less than 3,300 people) with most small water systems serving less than 500 people (see Table SJR-11). Small water systems face unique financial and operational challenges in providing safe drinking water. Given their small customer base, many small water systems cannot develop or access the technical, managerial and financial resources needed to comply with new and existing regulations. These water systems may be geographically isolated, and their staff often lack the time or expertise to make needed infrastructure repairs; install or operate treatment; or develop comprehensive source water protection plans, financial plans or asset management plans (USEPA 2012).

PLACEHOLDER Table SJR-11 Drinking Water Systems in the San Joaquin River Hydrologic Region

[Any draft tables, figures, and boxes that accompany this text for the public review draft are included at the end of the report.]

In contrast, medium and large water systems account for less than 20% of region's drinking water systems, however these systems deliver drinking water to over 90% of the region's population (see Table SJR-11). These water systems generally have financial resources to hire staff to oversee daily operations and maintenance needs, and hire staff to plan for future infrastructure replacement and capital improvements. This helps to ensure that existing and future drinking water standards can be met.

In the valley, many rural homes maintain wells for domestic purposes. These domestic wells tend to be shallower than agricultural wells due to the lower necessary flow rates. However, due to their shallow nature, they tend to draw water from nearer the ground surface which subjects them to potential contamination from percolating water or other sources.

Water Conservation Act of 2009 (SB x7-7) Implementation Status and Issues

Seventeen San Joaquin River urban water suppliers have submitted 2010 urban water management plans to DWR. The Water Conservation Law of 2009 (SBx7-7) required urban water suppliers to calculate baseline water use and set 2015 and 2020 water use targets. Based San Joaquin River Hydrologic Region had a population-weighted baseline average water use of 237 gallons per capita per day with an average population-weighted 2020 target of 196 gallons per capita per day. The Baseline and Target Data for the San Joaquin River urban water suppliers is available on the Department of Water Resources (DWR) Urban Water Use Efficiency website.

The Water Conservation Law of 2009 (SBx7-7) required agricultural water suppliers to prepare and adopt agricultural water management plans by December 31, 2012, and update those plans by December 31, 2015, and every 5 years thereafter. Seven San Joaquin River agricultural water suppliers have submitted 2012 agricultural water management plans to DWR.

Water Balance Summary

Figure SJR-9 summarizes the total developed water supplies and distribution of the dedicated water uses within this hydrologic region for the ten years from 2001 through 2010. As indicated by the variations in the horizontal bars, the distribution of the dedicated supply to various uses can change significantly based on the wetness or dryness of the water year. The more detailed numerical information about the developed water supplies and uses is presented in the Volume 5 Technical Guide, which provides a breakdown of the components of developed supplies used for agricultural, urban, and environmental purposes and Water Portfolio data.

PLACEHOLDER Figure SJR-9 San Joaquin Hydrologic Water Balance by Water Year, 2001-2010

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For the San Joaquin River Hydrologic Region, agricultural water uses are the largest component of the developed water uses, and urban water use is a very small portion of the total. Dedicated water required for instream flows and managed wetlands are also a significant component of water use in this region. Groundwater is also a significant source of supply for this region, and the reuse of agricultural water runoff is also a major source of supply to downstream water users.

The specific water balances for these areas is contained in Volume 5 of the California Water Plan Update.

The Upper West Side Uplands Planning Area (PA 601) contains more urban applied water (95-105 TAF annually), including substantial industrial and large landscape uses, than agricultural use (30-40 TAF). There is no environmental water use (managed wetlands or instream) in this PA.

Most of the water supply comes from local sources (about 60 -110 TAF annually). Some CVP deliveries are made (13-22 TAF). While come groundwater is extracted, more is recharged into the basin so there is a net recharge in recent years. About five thousand acre-feet of water is reused annually.

The San Joaquin Delta (PA 602) is both more populated (87 – 132 TAF urban applied water) and much more agricultural (0.75 to 1.1 million acre-feet applied water) than PA 601. There is also 0.5 to 0.6 TAF applied to managed wetlands.

Most of the water supply comes from local deliveries and drainage from upstream (660-960 TAF). Smaller amounts are delivered through the Central Valley Project, State Water Project and other federal projects (34 – 70 TAF total). The remainder of the supply comes from groundwater (25-50 TAF) and reuse (100-165 taf).

Planning Area 603, the Eastern Valley Floor, applies about the same amount of water for urban uses and maybe ten percent less for agricultural uses as PA 602. There is about 1 TAF applied water for managed wetlands, but no environmental instream requirements.

About sixty percent of the water supply comes from groundwater and forty percent from various surface water sources.

In the Sierra Foothills Planning Area (PA 604), urban applied water ranges from about 40 to 55 TAF and applied water for agricultural uses from 17-37 TAF. There are both instream requirements (95-300 TAF per year) and wild and scenic river designations (0.5 to 2.1 MAF), but no managed wetlands.

The instream requirement water supply (wild and scenic and instream requirements) comes from local sources, of course. The supplies for the agricultural and urban applied water come about equally from surface water and groundwater.

In the West Side Uplands Planning Area (PA 605), recordable water use (over about 50 acre-feet per year) didn’t start showing up until 2008. Urban use has grown from 0.1 TAF in 2008 to 0.4 TAF in 2010. There is no recordable agricultural or environmental use in this planning area. The water supply comes entirely from groundwater.

The Valley West Side Planning Area (PA 606) is primarily agricultural; with about 30 – 35 TAF Urban applied water and 1.5-1.9 MAF of agricultural applied water. There are no instream environmental requirements, but substantial managed wetlands with 426-454 TAF per year applied water.

Supply is primarily from the Central Valley Project (1.1-1.3 MAF) with substantial groundwater use (533 – 980 TAF annually). Limited local supplies, inflow drainage and SWP deliveries make up the difference.

The Upper Valley East Side, PA 607, uses about 150 TAF per year for urban uses and 0.9-1.1 MAF for agriculture. There is an instream requirement that takes about 100-470 TAF per year and some managed wetlands using about 13 TAF per year.

Most of the water supply comes from local sources and drainage from upstream sources. About 200-280 TAF comes from groundwater pumping and a small amount from the Central Valley Project.

The Middle Valley East Side Planning Area (PA 608) uses from about 66-79 TAF of urban water and 0.9-1.2 MAF of agricultural applied water per year. There is no environmental water use in this planning area. Between half and two-thirds of the water supply comes from local sources and the rest from pumping groundwater.

The Lower Valley East Side Planning Area (PA 609) urban areas apply 92-102 taf annually for primarily residential uses. Agricultural applied water is higher here also, at about 1.9-2.2 MAF per year. There are instream requirements here also, of about 68-84 TAF per year, all of which is reused downstream. Flows to managed wetlands equal about 45 TAF per year.

Most of the water supplies for AP 609 come from groundwater (1-1.6 MAF), with substantial amounts (30 to nearly 50 percent) returning to the groundwater basin. The rest of the supply comes from surface water sources (local supplies, inflow drainage from upstream and Central Valley Project) with the reuse from the instream requirements.

The East Side Uplands Planning Area (PA 610) is located on the west side of the Sierra Nevada Mountains which makes the area a source of supply for the valley, but limits it as either an agricultural or urban area. This shows up in the annual urban use of 15-17 taf and the agricultural use of 3-4 TAF. There is substantial wild and scenic river flow through there, all of which is reused downstream in other planning areas. The supply for the agricultural and urban uses comes from groundwater.

Table SJR-16 presents information about the total water supply available to this region for the 10 years from 2001 through 2010, and the estimated distribution of these water supplies to all uses. The annual change in the region’s surface water and groundwater storage is also estimated, as part of the balance between supplies and uses. In wetter water years, water will usually be added to storage; during drier water years, storage volumes may be reduced. Of the total water supply to the region, more than half is either used by native vegetation; evaporates to the atmosphere; provides some of the water for agricultural crops and managed wetlands (effective precipitation); or flows to the Pacific Ocean and salt sinks like saline groundwater aquifers. The remaining portion, identified as consumptive use of applied water, is distributed among urban and agricultural uses and for diversions to managed wetlands. For some of the data values presented in Table SJR-12, the numerical values were developed by estimation techniques because actual measured data are not available for all categories of water supply and use.

PLACEHOLDER Table SJR-12 San Joaquin River Hydrologic Region Water Balance for 2001-2010 (thousand acre-feet)

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Project Operations

The East Bay Municipal Utility District (EBMUD) and San Francisco Public Utilities Commission move water originating in the San Joaquin River Hydrologic Region across the valley for use in the San Francisco Bay Area. EBMUD transports water from the Mokelumne River via the Mokelumne Aqueduct. This water goes to Alameda and Contra Costa counties in the East Bay. The City/County of San Francisco and other nearby cities receive water through the Hetch Hetchy Aqueduct from the Tuolumne River.

Other facilities in this region include Camanche Dam/Reservoir on the Mokelumne River, Donnells and Beardsley dams/reservoirs on the Middle Fork of the Stanislaus River, Tulloch Dam/Reservoir, and New Melones Dam/Lake on the Stanislaus River, New Don Pedro Dam/Lake on the Tuolumne River, and New Exchequer Dam/Lake McClure on the Merced River.

US Army Corps of Engineers (USACE) projects on the eastside of the San Joaquin River watershed that impound streams tributary to the river are primarily flood dams and include Hidden Dam on the Fresno River, Buchanan Dam on the Chowchilla River, Mariposa Dam on Mariposa Creek, Owens Dam on Owens Creek, Bear Dam on Bear Creek, and Burns Dam on Burns Creek. Although flood control projects, this group of reservoirs has provided an average annual outflow over the last 35 years of about 230,000 acre-feet.

The SWP and the CVP transfer Delta water into the San Joaquin Valley along the west side. The federal pumping plant near Tracy pumps into the Delta-Mendota Canal, which travels to San Luis Reservoir then toward the trough of the valley to Mendota Pool. The State pumping plant near Byron pumps into the California Aqueduct, which travels to San Luis Reservoir then continues southward serving Kern County and Southern California. A portion of the California Aqueduct is a State-federal joint use facility serving the San Luis Unit of the federal project. San Luis Reservoir is a joint use pump storage facility.

Contra Costa Water District diverts from the Delta. Its Contra Costa Canal is fed from the Rock Slough Intake. Los Vaqueros Reservoir is filled using the Old River Intake; current construction of the Alternate Intake Project is in and around Victoria Island.

Most of the San Joaquin River is diverted at Lake Millerton/Friant Dam for use by federal water contractors. Water is moved northwestward in the Madera Canal and southeastward in the Friant-Kern Canal. Downstream, water reaching the Mendota Pool through the Delta-Mendota Canal may be released below the pool for contractual users. Previously, releases downstream into the river were primarily flood flows or to meet minimum flow requirements for prior water rights holders. For many decades, stretches of the river between Gravelly Ford and Mendota Pool and from Mendota Pool to the Merced River had minimal or no flows. However, in October 2009, interim flows began as part of the San Joaquin River restoration program, and in the fall of 2010, the often dry San Joaquin was reconnected to the Pacific Ocean. Full restoration flows are scheduled to begin no later than January 2014.

Levee and Channel System

Constructed facilities in the San Joaquin River Hydrologic Region consist of the San Joaquin River Flood Protection (SJRFP) system and other flood protection works. Regional facilities include eight major multipurpose reservoirs with flood management reservations, eight major flood management reservoirs, six smaller flood management reservoirs, bypasses, diversions, levees, channels and channel improvements, control structures, clearing and snagging, and bank protection.

The SJRFP system includes eight projects consisting of Farmington Flood Control Basin on Littlejohns Creek, Canal Creek Flood Detention Reservoir on Canal Creek, Bear Creek Flood Detention Reservoir on Bear Creek, Burns Creek Flood Detention Reservoir on Burns Creek, Owens Creek Flood Detention Reservoir on Owens Creek, Mariposa Creek Flood Detention Reservoir on Mariposa Creek, smaller reservoirs on Mustang Creek, Deer Creek, Dry Creek, the North Fork Tuolumne River, and Bear Creek, bypasses, diversions, levees, channels, channel improvements, control structures, clearing and snagging, and bank protection on the San Joaquin River and many of its major tributaries. The SJRFP system works together with most of the other listed reservoirs and lakes.

Regional multi-purpose reservoirs with flood control reservations are Millerton Lake on the San Joaquin River, Camanche Reservoir on the Mokelumne River, New Hogan Lake on the Calaveras River, New Melones Lake on the Stanislaus River, Don Pedro Lake on the Tuolumne River, Lake McClure on the Merced River, Eastman Lake on the Chowchilla River, and Hensley Lake on the Fresno River. Other major flood control reservoirs are Los Banos Reservoir on Los Banos Creek and Marsh-Kellogg Creeks Debris Reservoir on Marsh and Kellogg Creeks. Smaller reservoirs are on the Mokelumne and North Fork Mokelumne Rivers, and Deer, Dry, Bear, and Mustang Creeks.

A substantial portion of the San Joaquin River Hydrologic Region is within the implementation area of the 2012 Central Valley Flood Protection Plan (CVFPP). The CVFPP proposes a systemwide investment approach for sustainable, integrated flood management in areas currently protected by facilities of the State Plan of Flood Control (SPFC).

Major SPFC facilities along the San Joaquin River and tributaries include the following:

- Chowchilla Bypass (and levees), which begins at the San Joaquin River downstream from Gravelly Ford, diverts San Joaquin River flows, and discharges the flows into the Eastside Bypass
- Eastside Bypass (and levees), which begins at the Fresno River, collects drainage from the east, and discharges to the San Joaquin River between Fremont Ford and Bear Creek
- Mariposa Bypass, which begins at the Eastside Bypass and discharges to the San Joaquin River (and levees)

- Approximately 99 miles of levees along the San Joaquin River
- Approximately 135 miles of levees along San Joaquin River tributaries and distributaries
- Six instream control structures (Chowchilla Bypass Control Structure, San Joaquin River Control Structure, Mariposa Bypass Control Structure, Eastside Bypass Control Structure, Sand Slough Control Structure, and San Joaquin River Structure)
- Two major pumping plants

The SPFC represents a portion of the Central Valley flood management system for which the State has special responsibilities, as defined in the California Water Code Section 9110 (f). The State Plan of Flood Control Descriptive Document provides a detailed inventory and description of the levees, weirs, bypass channels, pumps, dams, and other structures included in the SPFC (DWR, 2010).

Over the last century, the Central Valley, including large portions of the San Joaquin River Hydrologic Region, has experienced intensive development to meet the needs of a growing population. A complex water supply and flood risk management system supports and protects a vibrant agricultural economy, several cities, and numerous small communities.

Much of the Central Valley levee system was built over many years using the sands, silts, clays, and soils, including organic soils that were conveniently available, often poorly compacted over permeable foundations. The system was designed to contain the record floods of the early 20th century with the aim of fostering development of an agriculturally oriented economy and promoting public safety. The subsequent construction of a series of multipurpose reservoirs with substantial flood control capability significantly augmented the capacity of the flood management system and contributed greatly to the State’s economic development and public safety objectives. These reservoirs constituted the principal response to the mid-century recognition that extreme floods that were much larger than those that guided design of the levee system were reasonably foreseeable.

Although the SPFC has prevented billions of dollars in flood damages since its construction, a better understanding of the risk assessment and engineering standards has made it clear that some SFPC facilities face an unacceptably high chance of failure. This, combined with continued urbanization in the floodplains, has increased the estimated level of flood risk. While the chance and frequency of flooding have decreased since construction of the SPFC and multipurpose reservoirs, the damages that would occur if a levee were to fail in one of the urban areas are much greater, resulting in a net long-term increase in cumulative damages if no action is taken to improve the flood management system and limit further development in these areas.

Water Quality

Salt management is the most serious long-term water quality issue in the San Joaquin River Basin. (CVRWQCB. 2011b). Water quality throughout the San Joaquin River Basin varies dependent upon source, geologic influences, and land uses.

Flows from the west side of the river basin are dominated by agricultural return flows since west side streams are ephemeral and their downstream channels are used to transport agricultural return flows to the main river channel. Poorer quality (higher salinity) water is imported from the Delta for irrigation along the west side of the river to replace water lost through diversion of the upper San Joaquin River flows. Flows from the east side of the River basin originate with snowmelt and springs in the Sierra Nevada, and therefore generally contain higher quality and volume of surface water. Water quality issues for the San Joaquin River Hydrologic Region include:

- Salinity
- Boron
- Selenium
- Pesticides (Chlorpyrifos, diazinon, pyrethroids, and organochlorine pesticides)
- Localized pesticide impairments identified for the following:
  - Dieldrin in Del Puerto Creek, Hospital Creek, Ingram Creek, Orestimba Creek and San Creek
  - Dimethoate in Ramona Lake, Del Puerto Creek, Hospital Creek, Ingram Creek, Orestimba Creek and Westley Wasteway
  - Diuron in Lone Tree Creek, Miles Creek, Del Puerto Creek, Orestimba Creek and the San Joaquin River
  - Simazine in Highline Canal, Mustang Creek and Newman Wasteway
- Metals (Mercury, copper and zinc)
- Nutrients (Low dissolved oxygen)
- Bacteria/E. Coli
- Erosion and Sediment
- Temperature. (SWRCB. 2010).

Since the 1940s, mean annual salt concentrations in the lower San Joaquin River at the Airport Way Bridge near Vernalis have doubled and boron levels have increased significantly. Water quality monitoring data collected by the Central Valley Water Board and others indicates that water quality objectives for salinity and boron are frequently exceeded in the lower San Joaquin River during certain times of the year and under certain flow regimes. The salt and boron water quality impairment in the lower San Joaquin River has occurred, in large part, as a result of large-scale water development coupled with extensive agricultural land use and associated agricultural discharges in the watershed. Lower San Joaquin River flows have been severely diminished by the construction and operation of dams and diversions and the resulting consumptive use of water. Most of the natural flows from the upper San Joaquin River and its headwaters are diverted at the Friant Dam via the Friant-Kern Canal to irrigate crops outside the San Joaquin River Basin. Diverted natural river flows have been replaced with poorer quality (higher salinity) imported water from the Sacramento-San Joaquin Delta that is primarily used to irrigate crops on the west side of the lower San Joaquin River basin. Surface and subsurface agricultural discharges are the largest sources of salt and boron loading to the lower San Joaquin River; and river water quality is therefore heavily influenced by irrigation return flows during the irrigation season. Water quality generally improves downstream as higher quality flows from the Merced, Tuolumne, and Stanislaus Rivers dilute salt and boron concentrations in the main channel of the lower San Joaquin River. (CVRWQCB. 2004).

Soils on the west side of the San Joaquin River Basin are derived from rocks of marine origin in the Coast Range that are high in selenium and salts. Dry conditions make irrigation necessary for nearly all crops grown commercially in the watershed. Irrigation of the soils derived from these marine sediments leaches selenium and salt into the shallow groundwater. Subsurface drainage is produced when farmers drain the shallow groundwater from the root zone to protect their crops. This subsurface agricultural drainage water is high in naturally occurring salts and selenium. The discharge of subsurface drainage from the west side has resulted in violations of water quality objectives in Salt Slough, the San Joaquin River, and other water bodies in the area, see Figure SJR-10. Selenium is a highly bioaccumulative trace element, which, under certain conditions, can be mobilized through the food chain, and cause both acute and chronic toxicity to waterfowl. Deformities and deaths of waterfowl have been linked to toxic concentrations of selenium. (CVRWQCB, 1999; CVRWQCB, 2000 and CVRWQCB, 2001).

PLACEHOLDER Figure SJR-10 Salt Slough and Mud Slough

[Any draft tables, figures, and boxes that accompany this text for the public review draft are included at the end of the report.]

Pesticides causing impairment of the San Joaquin River Hydrologic Region water ways are man-made chemicals used to control pests, insects and undesirable vegetation in urban and agricultural landscapes. A fraction of the applied pesticides can enter waterways during rainfall or irrigation events when residual pesticides migrate in stormwater runoff or irrigation return water or migrate with sediment carried in stormwater runoff or irrigation return water and cause unintended toxicity to aquatic life.

Inorganic mercury enters waterways when soils erode, atmospheric dust falls to the ground, and mineral springs discharge. Another significant source is cinnabar ore (mercury sulfide) that was mined in the Inner Coast Ranges for elemental mercury (quicksilver). This liquid form of mercury was transported from the Coast Ranges to the Sierra Nevada for gold recovery where several million pounds of mercury were lost to the environment during the gold rush. In various aquatic environments, inorganic mercury can be converted to methylmercury, which is a potent neurotoxin. Methylmercury is readily absorbed from water and food, and therefore concentrations multiply greatly between water and top predators of aquatic food chains. The production of methylmercury and uptake in the food chain is influenced by natural factors and by many human activities. Fish with elevated concentrations of methylmercury pose a risk to people and wildlife that eat the fish. Many streams and reservoirs in the San Joaquin River Hydrologic Region contain fish with elevated concentrations of methylmercury.

The “copper belt” in the lower Sierra Nevada foothills is an area with natural copper deposits and roughly spans from Amador County to Tuolumne County. Discharges from abandoned mines contain levels of copper, arsenic, pH and salts which are a concern for aquatic life.

Low dissolved oxygen and nutrient enrichment issues have been identified in the south and eastern Delta and in the upper Fresno River, Los Banos Creek and Kellogg Creek. In the Delta, low dissolved oxygen concentrations may act as a barrier to upstream spawning migration of salmonids. In the Delta and elsewhere, low dissolved oxygen concentrations may stress and kill resident aquatic organisms. Oxygen demanding substances are generally the likely cause of low dissolved oxygen impairments; although, in the Deep Water Ship Channel portion of the San Joaquin River, channel geometry and reduced flows have also been identified as causes of the impairment. (CVRWQCB. 2005a).

High levels of indicator organisms were found in the south Delta and in various water bodies in the San Joaquin River watershed. Indicator organisms are used to infer the potential for the presence of disease-causing pathogens because pathogenic organisms are difficult to identify and isolate. High levels of the indicator organisms show an increased potential for human health risks. Water quality criteria have been established to protect for recreational use in ambient waters. (USEPA. 1986).

Erosion and sedimentation is a water quality concern in the San Joaquin River Hydrologic Region. Agricultural, forest management, mining, land development, and dredging activities can result in excessive erosion and discharge of sediments to surface waters. Sedimentation impairs fisheries and, by virtue of the characteristics of many organic and inorganic compounds to bind to soil particles, it serves to distribute and circulate toxic substances through the riparian, estuarine, and marine systems. (CVRWQCB. 2011c).

Temperature impairments have been identified for the Lower Merced River, the Lower Stanislaus River, the Lower Tuolumne River and the Lower San Joaquin River. (SWRCB. 2010). The activities of fish are controlled by temperatures in the aquatic environment. Extremes of temperature, whether hot or cold, produce adverse effects in fish. The tolerance of fish to temperature extremes varies with the life stage, whether egg, fry, fingerling, smolt, or adult. In addition to direct effects of temperature on fish, indirect effects due to temperature also occur that can limit fish populations. Such effects include altered food abundance and conversion efficiency, increased predation, temperature-mediated disease, dissolved oxygen, and increased toxicity of various compounds. (DWR. 1988.). In the San Joaquin River Basin, one critical factor limiting anadromous salmon and steelhead population abundance is high water temperatures which exist during critical life-stages in the tributaries and the main-stem. This results largely from water diversions, hydroelectric power operations, water operations and other factors. (Loudermilk. 2007).

Drinking Water Quality

In general, drinking water systems in the region deliver water to their customers that meets federal and state drinking water standards; nonetheless, local groundwater supplies have been found to be contaminated. Recently the SWRCB completed a draft statewide assessment of community water systems that rely on contaminated groundwater. This draft report identified 104 community drinking water systems in the region that rely on at least one contaminated groundwater well as a source of supply (See Table SJR-13). Common naturally occurring contaminants, arsenic, gross alpha particle activity, and uranium are the most prevalent groundwater contaminants affecting community drinking water wells in the region. A number of community drinking water wells are also affected by nitrate and 1,2-Dibromo-3-chloropropane (DBCP) which are attributed to anthropogenic sources of contamination (see Table SJR-14). The majority of the affected systems are small water systems which often need financial assistance to construct a water treatment plant or alternate solution to meet drinking water standards.

PLACEHOLDER Table SJR-13 Summary of Community Drinking Water Systems in the San Joaquin River Hydrologic Region that Rely on One or More Contaminated Groundwater Wells that Exceed a Primary Drinking Water Standard

[Any draft tables, figures, and boxes that accompany this text for the public review draft are included at the end of the report.]

PLACEHOLDER Table SJR-14 Summary of Contaminants Affecting Community Drinking Water Systems in the San Joaquin River Hydrologic Region

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Groundwater Quality

The following are the contaminants of concern in groundwater for this region:

- Salinity (CVRWQCB. 2011b)
- Nitrate (Dubrovsky. 1998, Burow. 2008, SWRCB. 2012b)
- Arsenic (SWRCB. 2012b and USGS. 2012)
- Gross Alpha Particle Activity and Uranium (SWRCB. 2012b and USGS 2012)
- Chromium 6 (SWRCB. 2011b)
- Localized Contamination by tetrachloroethylene (PCE) and trichloroethylene (TCE) (SWRCB. 2012b)

Salt management is the most serious long-term water quality issue in the San Joaquin River Basin. The causes include increased urban and agricultural development, over allocation of surface water supplies, diversion of high quality flows to outside the basin, salty return flows from agriculture and higher salinity water being imported into the basin. Approximately 600,000 tons of salt are imported annually into the western portion of the San Joaquin Basin (west of the San Joaquin River) for crop irrigation and wetland management via federal, state, and local water projects. An additional 160,000 tons are applied through irrigation from San Joaquin River diversions. Some of this salt is returned to the river through tail water return flows and some is stored in the soil. Most, however, is purposefully leached below the root zone to maintain salt balance in the root zone. Much of this leached salt ends up in the groundwater. Degradation of groundwater in the San Joaquin River Basin by salts is unavoidable without a plan to remove salts from the basin. (CVRWQCB. 2011b).

Nitrate concentrations in 24 percent (21 of 88) of the domestic wells sampled during 1993–95 in the regional aquifer survey and land-use studies of the eastern San Joaquin Valley exceeded the drinking-water standard of 10 mg/L established by the USEPA. Pesticides were detected in 61 of the 88 domestic wells sampled during 1993-95 (69 percent), but concentrations of most pesticides were low - less than 0.1 mg/L. (Dubrovsky. 1998). Concentrations of nitrate and pesticides in the shallow part of the aquifer system at depths of domestic wells in the study area have increased over time due to continued contributions of nitrates and current use pesticides in the recharge water. Also, concentrations of nitrates and pesticides in the shallow part of the aquifer are likely to move to deeper parts of the ground-water flow system. (Burow. 2008). Public supply wells with impacted source water are generally located on the valley floor. (SWRCB. 2012b).

Public supply wells with levels of arsenic in the raw and untreated water that exceed the maximum contaminant level (MCL) were found in the eastern portion of the valley floor and in the foothills of Madera County. Arsenic is generally considered to be naturally occurring. (SWRCB. 2012b and USGS. 2012). Arsenic has been linked to cancer of the bladder, lungs, skin, kidney, nasal passages, liver, and prostate. (USEPA. 2012a).

Gross alpha particle activity and uranium were found in raw and untreated water for many of the public water systems in the foothills and mountain parts of this hydrologic region. These radionuclides are typically naturally occurring but are a concern because of the potential for health effects. (SWRCB. 2012b and USGS. 2012).

Chromium is a metal found in natural deposits of ores containing other elements, mostly as chrome-iron ore. It is also widely present in soil and plants. Recent sampling of drinking water throughout California suggests that hexavalent chromium may occur naturally in groundwater at many locations. Chromium may also enter the environment from human uses. Chromium is used in metal allows such as stainless steel; protective coatings on metal; magnetic tapes, and pigments for paints, cement, paper, rubber, composition floor covering, etc. Elevated levels (above the detection limit of 1 μg/l) of hexavalent chromium have been detected in many active and standby public supply wells along the west or valley floor portion of the Central Valley. (SWRCB. 2011b).

There were very few occurrences of organic compounds in public supply wells in the San Joaquin River Hydrologic Basin. Organic compounds of concern found at levels above the MCLs in raw and untreated water from public supply wells were tetrachloroethylene (PCE) and trichloroethylene (TCE) in one well in Madera County, two wells in San Joaquin County and one well in Stanislaus County.

Aquifer Conditions and Issues

This section is under development.

Flood Management

Traditionally, the approach to flood management was to develop narrowly focused flood infrastructure projects. This infrastructure often altered or confined natural watercourses, which reduced the chance of flooding thereby minimizing damage to lives and property. This traditional approach looked at floodwaters primarily as a potential risk to be mitigated, instead of as a natural resource that could provide multiple societal benefits.

Today, water resources and flood planning involves additional demands and challenges, such as multiple regulatory processes and permits, coordination with multiple agencies and stakeholders, and increased environmental awareness. These additional complexities call for an Integrated Water Management approach, that incorporates natural hydrologic, geomorphic, and ecological processes to reduce flood risk by influencing the cause of the harm, including the probability, extent, or depth of flooding (flood hazard). Some agencies are transitioning to an IWM approach. IWM changes the implementation approach based on the understanding that water resources are an integral component for sustainable ecosystems, economic growth, water supply reliability, public health and safety, and other interrelated elements. Additionally, IWM acknowledges that a broad range of stakeholders might have interests and perspectives that could positively influence planning outcomes.

Damage Reduction Measures

Flood exposure in the San Joaquin Hydrologic Region occurs primarily along the San Joaquin River; however, significant flooding has also occurred on the Fresno, Merced, Mokelumne, and Stanislaus rivers. Floods within the San Joaquin River Region originate principally from melting of the Sierra snowpack and from rainfall. Most flood events occur in December and January as a result of multiple storms and saturated soil conditions, but floods can occur in October and November or during the late winter or early spring months.

In the San Joaquin River Hydrologic Region, more than 535,000 people and around $40 billion in structures are exposed to the 500-year flood event. There is also more than $1.9 billion in agriculture crop value exposed in the region. Table SJ-15 provides a snapshot of people, structures, crops, infrastructure exposed to flooding in the region. Over 260 State and Federal threatened, endangered, listed, or rare plant and animal species exposed to flood hazards are distributed throughout the San Joaquin River Hydrologic

Region.

PLACEHOLDER Table SJR-15 San Joaquin River Hydrologic Region Exposures within the 100-year and 500-Year Floodplains

[Any draft tables, figures, and boxes that accompany this text for the public review draft are included at the end of the report.]

Levee Performance and Risk Studies

Flood Hazard mitigation planning is an important part of emergency management planning for floods and other disasters. Hazard Mitigation is defined as any sustained action taken to reduce or eliminate long-term risk to human life and property from hazards. Hazard Mitigation Planning is the process through which natural hazards that threaten communities are identified, likely impacts of those hazards are determined, mitigation goals are set, and appropriate strategies that would lessen the impacts are determined, prioritized, and implemented. Hazard Mitigation Planning is required for state and local governments to maintain their eligibility for certain Federal disaster assistance and hazard mitigation funding programs.

Multi-Hazard Mitigation Plans (MHMPs) are required by FEMA as a condition of pre- and post-disaster assistance. The Stafford Act, as amended by the Disaster Mitigation Act of 2000, provides for states, tribes, and local governments to undertake a risk-based approach to reducing risks to natural hazards through mitigation planning. The National Flood Insurance Act reinforced the need and requirement for mitigation plans linking flood mitigation assistance programs to State, tribal and local mitigation plans. FEMA-approved MHMPs were on file for a number of counties in the hydrologic region. Other risk assessment studies were prepared by various entities including USACE, FEMA, and the State Reclamation Board of California. For a complete list of studies, refer to California's Flood Future Report Attachment G: Risk Information Inventory Technical Memorandum.

One specific study, the Central Valley Flood Protection Plan (CVFPP) was developed to address flood risk. The Central Valley Flood Protection Act of 2008 directed the California Department of Water Resources to prepare this report. The CVFPP is a flood management planning effort that addresses flood risks and ecosystem restoration opportunities in an integrated manner while concurrently improving ecosystem functions, operations and maintenance practices, and institutional support for flood management. It specifically proposes a systemwide approach to flood management for the areas currently protected by facilities of the State Plan of Flood Control (SPFC). Under this approach, California will prioritize investments in flood risk reduction projects and programs that incorporate ecosystem restoration and multi-benefit projects. The CVFPP was adopted by the Central Valley Flood Control Board on June 29, 2012. It is expected that the CVFPP will be updated every 5 years thereafter. The CVFPP proposes a systemwide approach to address the following issues:

- Physical improvements in the Sacramento and San Joaquin River basins
- Urban flood protection
- Small community flood protection
- Rural/Agricultural area flood protection
- System improvements
- Non-SPFC levees
- Ecosystem restoration opportunities
- Climate change considerations

In the San Joaquin River Hydrologic Region fifty-four local flood management projects or planned improvements were identified. The local flood management projects can be found in California's Flood Future Report. Of this total, 47 projects have identified costs totaling about $735 million while the remaining projects do not have costs associated with them at this time. Twenty-four local planned projects implement this Integrated Water Management (IWM) approach. Example projects include the Big Bend Floodplain Protection and Restoration Project, the Farmington Groundwater Recharge and Seasonal Habitat Program, and the Lower San Joaquin River Flood Bypass Project. For a complete list of projects, refer to California's Flood Future Report Attachment G: Risk Information Inventory Technical Memorandum.

Water Governance

The San Joaquin River Hydrologic Region's water management activities are generally governed by counties, cities, and special districts created to perform specific water-related functions. Federal entities within the region with water management responsibilities include the US Bureau of Reclamation and the US Army Corps of Engineers.

The interregional water conveyance systems of the CVP and SWP are operated by federal and State governments, respectively. The Madera Canal is part of the Friant Division of the USBR and is operated by the Friant Water Authority, while the Delta-Mendota Canal is part of the Delta Division of the USBR and operated by the SLDMWA. The San Luis Canal/California Aqueduct (a joint federal-state project), which runs from the O`Neill Forebay to Kettleman City is operated by the San Luis Unit of the USBR.

Local developed surface water systems include the Calaveras River waterworks for the Calaveras County Water District; Mokelumne River diversion points/canals for North San Joaquin WCD, Amador WA, and Calaveras Co. WD; Stanislaus River diversion points/canals for Calaveras Co. WD, Tuolumne UD, Oakdate Irrigation District, and South San Joaquin ID; Tuolumne River waterworks for the Turlock ID, Modesto ID, and TUD; Fresno River diversion points/canals for Madera ID; Chowchilla River diversion points/canals for the Chowchilla WD; Merced River diversion points for Merced ID; and San Joaquin River diversion points/canals for Patterson WD, West Stanislaus ID and the San Joaquin River Exchange Contractors (CCID, San Luis Canal Co., Firebaugh Canal Co., and Columbia Canal Co.).

Table SJR-16 lists a selection of organizations involved in water governance in the region. A list of regional flood management participants is included in the Flood Management section, and an Integrated Regional Water Management (IRWM) discussion can be found in the IRWM section.

PLACEHOLDER Table SJR-16 Selection of Organizations in the San Joaquin River Hydrologic Region in Water Governance

[Any draft tables, figures, and boxes that accompany this text for the public review draft are included at the end of the report.]

Changes to Integrated Regional Water Management (IRWM) within the San Joaquin River hydrologic region since CWP Update 2009 include the following:

- The conditionally-approved Central California IRWM group (which once included the Merced and Madera IRWM Regions) dissolved, re-organized and re-formed as the Yosemite-Mariposa IRWM group, receiving full approval as an IRWM Region in round 2 of the Region

Acceptance Process (RAP) in 2010-2011;

- The Madera, Merced, and Southern Sierra IRWM groups moved from conditionally-approved to fully approved IRWM Regions during round 2 RAP 2010-2011;
- The East Stanislaus IRWM group formed and was approved as an IRWM region during round 2 RAP 2010-2011.

State Funding Received

Integrated Regional Management is divided into four main grant programs from three propositions: Prop. 50 Planning Grants; Prop. 84 Planning Grants; Prop. 84 Implementation Grants; and Prop. 1E Stormwater Flood Management Grants. Table SJR-17 lists those groups that received grant funds in the San Joaquin River region.

PLACEHOLDER Table SJR-17 Integrated Regional Water Management Grants Awarded in the San Joaquin River Hydrologic Region

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Flood Governance

California's water resource development has resulted in a complex, fragmented, and intertwined physical and governmental infrastructure. Although primary water management responsibility might be assigned to a specific local entity, aggregate responsibilities are spread among 280 agencies and cities in the San Joaquin River Hydrologic Region with many different governance structures. For a list of agencies, refer California's Flood Future Report Attachment E: Information Gathering Technical Memorandum. Agency roles and responsibilities can be limited by how the agency was formed, which might include enabling legislation, a charter, a memorandum of understanding with other agencies, or facility ownership.

The San Joaquin River Hydrologic Region contains floodwater storage facilities and channel improvements funded and/or built by the State and Federal agencies. Flood management agencies are responsible for operating and maintaining water management facilities, including: more than 4,750 miles of levees, more than 260 dams and reservoirs, and other facilities in the hydrologic region. For a list of major infrastructure, refer California's Flood Future Report.

Water Code Division 5, Sections 8,000 - 9,651 have special significance to flood management activities in the Delta and are summarized in California's Flood Future Report Attachment E: Information Gathering Technical Memorandum.

Current Relationships with Other Regions and States

Interregional and Interstate Planning Activities

The San Joaquin River Hydrologic Region provides water to other regions and receives water as well. CVP water is brought in from the Delta and distributed to San Joaquin River Exchange Contractors. This makes water available at Friant Dam for distribution in the Friant Unit of the CVP. State water is brought into the region through the SWP's California Aqueduct. The existence of major water project transport facilities traversing the region enhances the potential for water exchanges and transfers. Water for the federal San Felipe Project is transported through the west side of San Luis Reservoir to coastal areas.

During periods of high runoff, San Joaquin River water can be transported to the Tulare Lake Hydrologic Region in the Friant-Kern Canal to the Kern River. From the Kern River water can be placed into the California Aqueduct via the Kern River Intertie.

During periods of high flows, Kings River water may be diverted from the Tulare Lake Hydrologic Region into the San Joaquin River via Fresno Slough and the James Bypass. At these times, the Kings River Water Association coordinates closely with USACE and operators of the reservoirs on San Joaquin River tributaries. All parties participate in daily operators' conferences sponsored by DWR's Flood Operations Center.

The regional map in Figure SJR-7 (above) depicts these regional imports and exports.

The Folsom South Canal originates at Lake Natoma near Folsom Dam, originally part of the USBR's CVP intended to transport American River water nearly to Stockton. Approximately 14.5 thousand acre-feet of tail water per year flows through the facility into the region to Galt Irrigation District. The southern portion of the canal will be used in the Freeport Regional Water Project to transport water in dry years to EBMUD.

The San Francisco Bay Hydrologic Region receives surface water that originates in the San Joaquin River region. EBMUD serves communities on the east side of San Francisco Bay with water from the Mokelumne River via the Mokelumne Aqueduct. The Mokelumne River supplies more than 96 percent of the water supply to EBMUD, serving almost 1.3 million people. The San Francisco Water Department provides water from the Tuolumne River through the Hetch Hetchy Aqueduct. This is the sole source water supply for 1.3 million people and a partial source for an additional 1.4 million people. Nearly 4 million Bay Area people receive water from these two San Joaquin River Hydrologic Region watersheds/projects.

In November 2004, DWR and the California Department of Parks and Recreation reviewed the many Hetch Hetchy Valley restoration studies prepared during the previous 20 years. Hetch Hetchy Valley is inundated by the waters of the Tuolumne River behind O'Shaughnessy Dam in Yosemite National Park, Tuolumne County. The review included local, State, and federal resource plans to assist in the evaluation of water supply and quality, operational considerations, flood and drought impacts, and environmental and energy issues. The review concluded that many other aspects of restoration needed in-depth study. These included a replacement water supply, public input, other stakeholder interests, a dam removal plan, and public use and benefits evaluation. Although no recommendation was made as to the restoration, cost estimates (making broad assumptions) ranged from $3 billion to $10 billion. The results were documented in the Hetch Hetchy Restoration Study (CNRA 2006).

In 1998, Contra Costa Water District completed Los Vaqueros Reservoir, which can store 100 thousand acre-feet. This is an offstream reservoir in the northwest corner of the San Joaquin River region. The reservoir stores Contra Costa Water District water that has been diverted from the Delta in winter and spring. Water is typically withdrawn from Los Vaqueros Reservoir in the summer and fall to improve the quality of water delivered to the district's service areas. The reservoir also provides emergency storage. A portion of the Contra Costa Water District service area is in the San Francisco Bay Hydrologic Region. The reservoir area provides recreational opportunities such as multi-use trails (hiking, bicycling, and equestrian), animal and bird sighting, fishing, and rental boating.

In December 2010, Contra Costa Water District contracted to expand the reservoir to 160 taf by raising the dam by 34 feet. Construction began in April 2011, and the expanded reservoir/dam was dedicated in July 2012.

Regional Water Planning and Management

Water agencies, cities and counties, utility organizations, and other stakeholders are planning individually and collectively to address growth, water supply, flood management, water management, and ecosystem issues. Efforts to increase effective use of groundwater storage, surface storage, and conveyance facilities are apparent in planning documents throughout the region. Conjunctive management, increased efficiency, conservation, reclamation, recycling, and reuse are themes throughout urban and agricultural water management plans.

The San Joaquin Valley Water Coalition was established in 1998 to promote the water interests of its valley members. Among its major members were counties within the San Joaquin Valley. Much of the counties' efforts have been shifted to the San Joaquin Valley Regional Blueprint Planning Process and the San Joaquin Valley Regional water plan. The SJVR Blueprint Planning Process was started by the Councils of Government from each of the San Joaquin Valley's counties, including Merced, Madera, San Joaquin, and Stanislaus in the San Joaquin River region. One of its aims is to provide a comprehensive and integrated decision-making tool that combines separate and distinct data sets into a single set. This will allow for scenario planning, more efficient use of resources, and an understanding of regional impacts and solutions. The SJVR Water Plan was initiated by valley lawmakers who were interested in creating a comprehensive, integrated plan for the valley's water resources. The California Water Institute at California State University, Fresno was tasked with coordinating the eight-county planning effort. The CWI developed the Framework for the Implementation of Water Planning (Framework) for long-term San Joaquin Valley water management. The effort is critical to identify the valley water needs and determine water management solutions for a fifty-year planning horizon. The framework was unanimously adopted by the California Partnership for the San Joaquin Valley Board of Directors on October 22, 2009.

California Partnership for the San Joaquin Valley was established in 2005 to identify potentially effective projects and programs, identify critical needs, review State policies and regulations, and make recommendations to the governor. The partnership includes eight State government members, eight local government members, and eight private sector members. The partnership was extended one additional year by executive order in December 2008. Then in July 2010, Executive Order S-10-10 extended the Partnership indefinitely and established governance guidelines. For more information please visit: http://sjvpartnership.org/.

The Grasslands Bypass Project is an ongoing activity and example of planning and implementation of a program dealing with water quality, environmental concerns, and San Joaquin River conditions. Prior to 1996, agricultural drainage water passed through wetland areas in western Merced County. The drainage water contains constituents harmful to wildlife. Subsequently, this drainage water has been routed around the Grasslands wetlands into Mud Slough and discharged into the San Joaquin River upstream of the Merced River. The water is monitored for constituents to meet discharge requirements considering the assimilative capacity of the river.

The San Joaquin River Parkway and Conservation Trust was created in 1988. One purpose of the trust was to create a 22-mile parkway along the San Joaquin River in the Fresno/Madera area. The trust restores, preserves, and maintains the ecological, scenic, and historic aspects of the area. It also provides educational and recreational opportunities and experiences in the parkway. For more information please visit: http://riverparkway.org/index.php.

Integrated Regional Water Management Coordination and Planning

The IRWM Planning Act, signed by the Governor as part of SB 1 in 2008, provides a general definition of an IRWM plan as well as guidance to DWR as to what IRWM program guidelines must contain (CWC Sec 10530 et seq.). The Act states that the guidelines shall include standards for identifying a region for the purposes of developing or modifying an IRWM plan. The first regional acceptance process (RAP) spanned 2008-2009. Final decisions were released in fall 2009. The RAP is used to evaluate and accept an IRWM region into the IRWM grant program. Many IRWM regions have been proposed, some approved and some conditionally approved. Figure SJR-11 shows RAP regions in this hydrologic region. Table SJR-18 lists strategies from earlier IRWM efforts.

PLACEHOLDER Table SJR-18 Strategies of Integrated Water Management Efforts in the San Joaquin River Hydrologic Region

[Any draft tables, figures, and boxes that accompany this text for the public review draft are included at the end of the report.]

PLACEHOLDER Figure SJR-11 Integrated Regional Water Management Regions in the San Joaquin River

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Implementation Activities (2009-2013)

Surface Water Quality and Central Valley Water Board Implementation

The Regional Water Quality Control Boards are responsible for protecting the water quality of the waters of the state and have regulatory and non-regulatory programs that can address the water quality concerns of this area. The individual Regional Water Quality Control Boards adopt water quality control plans or basin plans that lay out the framework for how the Board will protect water quality in each region. The basin plans designate the beneficial uses of surface and ground water in the region, water quality objectives to meet the beneficial uses and establish an implementation program to achieve the water quality objectives and protect the beneficial uses. The implementation program describes how the Board will coordinate its regulatory and non-regulatory programs to address specific water quality concerns.

Overarching all the Central Valley Water Board’s programs and activities is the development of a comprehensive salt and nitrate management plan for the Central Valley. The Central Valley Water Board and the State Water Board, as part of a stakeholder coalition, are working on Salinity Alternatives for Long-Term Sustainability (CV-SALTS), which is a strategic initiative to address problems with salinity and nitrates in the surface waters and ground waters of the Central Valley. The long-term plan developed under CV-SALTS will identify and require discharger implementation of management measures aimed at the reduction and/or control of major sources of salt and nitrate as well as support activities that alleviate known impairments to drinking water supplies. The eventual salt and nitrate management plan will provide guidance across all the Central Valley Water Board's regulatory and non-regulatory programs on how to address salinity and nitrate concerns. As this issue impacts all users (stakeholders) of water within the San Joaquin River Hydrologic Region, it is important that all stakeholders participate in CV-SALTS to be part of the development and have input on the implementation of salt and nitrate management within the San Joaquin River area. For the Central Valley, the only acceptable process to develop the salt and nutrient management plans that are required under state policy is through CV-SALTS (SWRCB. 2009).

CV-SALTS will include basin plan amendments that establish regulatory structure and policies to support basin-wide salt and nitrate management. The regulatory structure will have four key elements: (1) refinement of the agricultural supply (AGR), municipal and domestic supply (MUN) and groundwater recharge (GWR) beneficial uses; (2) revision of water quality objectives for these uses; (3) establishment of policies for assessing compliance with the beneficial uses and water quality objectives; and (4) establishment of management areas where there are large scale differences in baseline water quality, land use, climate conditions, soil characteristics and existing infrastructure and where short and long term salt and/or nitrate management is needed. For the San Joaquin River Hydrologic Region, CV-SALTS plans to implement pilot projects to demonstrate revision of water quality objectives for salt and boron in the San Joaquin River; and evaluation of beneficial uses and water quality objectives for agricultural water bodies. (CV-SALTS. 2012a and CV-SALTS, 2012b).

Surface Water

The Central Valley Water Board has adopted basin plan implementation programs (that include TMDLs) to address salt and boron in the San Joaquin River at Vernalis; selenium in the San Joaquin River that also addresses impairments in Salt Slough and the Grasslands Marshes; diazinon and chlorpyrifos in the San Joaquin River and the Delta; mercury in the Delta and dissolved oxygen in the Stockton Deep Water Ship Channel. (CVRWQCB. 2004, CVRWQCB. 1999, CVRWQCB. 2000, CVRWQCB. 2001, CVRWQCB. 2005b, CVRWQCB. 2006, CVRWQCB. 2010 and CVRWQCB. 2005a). Outside of the Basin Plan, the Central Valley Water Board has adopted a TMDL for pathogens in the Stockton urban water bodies (CVRWQCB. 2008). The basin plan implementation programs describe how the Water Board will use its authority to regulate controllable factors to restore water quality.

The Central Valley Water Board has regulatory programs to protect and restore the quality of surface waters. These programs include:

- The Irrigated Lands Regulatory Program regulates discharges from irrigated agriculture through surface water monitoring and the development and implementation of management plans to address water quality problems identified in the surface water monitoring. This program addresses materials used in agricultural production that may end up in surface water, such as pesticides as well as pollutants that may be concentrated or mobilized by agricultural activities such as salt. In this program, coalition groups representing growers monitor to identify constituents of concern. Management plans are developed which identify management practices that individual growers implement to reduce the concentrations of the constituents of concern in surface water. Follow-up monitoring is conducted to confirm that water quality standards are met. Growers work together under a coalition group to meet the program requirements. (CVRWQCB. 2011d).
- Water quality coalitions currently active in the San Joaquin River Basin include the East San Joaquin Water Quality Coalition, San Joaquin County and Delta Water Quality Coalition, and

Westside San Joaquin River Watershed Coalition. In addition to addressing the Basin Plan implementation programs for salt and boron, organophosphate pesticides and dissolved oxygen, management plans have been developed and implemented to address chlorpyrifos, diazinon, diuron, dimethoate, methyl-parathion, simazine, malathion, thiobencarb, water column and sediment toxicity, and e. coli. (CVRWQCB. 2011a and CVRWQCB. 2012a).

- The Grasslands Bypass Project was established to implement the Basin Plan selenium control program for the San Joaquin River. The Project routes subsurface agricultural drainage water with elevated levels of selenium, salts and other constituents of concern away from wildlife refuges and wetlands. The goal is to reduce and reuse high selenium subsurface agricultural drainage to comply with the Basin Plan load limits for the San Joaquin River and its tributaries.
- The National Pollutant Discharge Elimination System (NPDES) permit program regulates the discharge of point source wastewaters and urban runoff to surface waters. Point source wastewater can contain elevated levels of salt and nitrates, pesticides, mercury and other metals, oxygen demanding substances and bacteria. Urban runoff can contain pesticides, mercury and other metals, oxygen demanding substances, bacteria and sediment. Permits prevent the discharge of elevated concentrations of these constituents. In cases where elevated levels of constituents of concern are being discharged, permits require dischargers to develop and implement measures to reduce the levels of these constituents.
- The Discharge to Land Program oversees the investigation and cleanup of impacts of current and historic unauthorized discharges including discharges from historic mining activities. Historic mine impacts include mercury impairments from mercury mines found on the Coast Range side of the Central Valley and mercury impairments from the use of mercury to amalgamate gold in the mines on the Sierra side. Other metal impairments result from the copper mining that occurred in the foothills area of the Sierra. Sedimentation can be a problem in the construction and operation of many mines. [The below pictures are of Calfed Mine in Amador County. Pictures courtesy staff of Central Valley Water Board. Also available at: http://www.waterboards.ca.gov/centralvalley/water_issues/mining/region5_success_stories/calfed_copper_mine/index.shtml

PLACEHOLDER Photo SJR-1 Mine Waste

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- The Timber Program provides review, oversight and enforcement of timber harvest activities on both private and U.S. Forest Service lands. The primary responsibility of the program is review and inspection of harvest activities. Timber harvest activities pose a threat to water quality through the potential for sediment and herbicide discharges and temperature increases to surface waters. During the past five years, in the San Joaquin River Hydrologic Region, private timberland owners have submitted 136 timber harvest plans that allow harvesting on over 53 thousand acres.
- The Water Quality Certification Program evaluates discharges of dredge and fill materials to assure that the activities do not violate state and federal water quality standards. One of the goals of the program is to protect wetlands and riparian areas from dredge and fill activities and to implement state and federal “no net loss” policies for wetlands. Constituents of concern addressed by this program are salts and nutrients, methylmercury and temperature.
- The Nonpoint Source program supports local and regional watershed assessment, management,

and restoration to enhance watershed conditions that provide for improved flow properties and water quality. Nonpoint sources include agriculture, forestry, urban discharges, discharges from marinas and recreational boating, hydromodification activities and wetlands, riparian areas and vegetated treatment systems. For some of these sources, such as irrigated agriculture and forestry, the Central Valley Water Board has specific regulatory programs. The Nonpoint Source Program addresses sources where the Central Valley Water Board has not developed a specific program. This program has assisted stakeholders obtain funding to address nonpoint source pollution as well as conduct riparian and habitat restoration activities. Impacts from recreational activities such as off highway vehicle (OHV) use fall under this program. In 2012, the Central Valley Water Board found that sediment disturbed by recreational vehicle activity and transported in storm water runoff to Corral Hollow Creek was a water quality problem at the Carnegie State Vehicle Recreation Area. The Board also identified metals, such as copper and lead, as a potential concern. To address these problems, the Board issued a Cleanup and Abatement Order to the California Department of Parks and Recreation (State Parks). The Order recognized that State Parks had developed a Storm Water Management Plan that describes the best management practices that need to be implemented to address erosion and sedimentation. The Order required State Parks to update and implement the Storm Water Management Plan. (CVRWQCB. 2012b).

Monitoring of the San Joaquin River for flow and quality has been fairly regular over the past years but recently there has been a dramatic drop in the amount of monitoring occurring of the San Joaquin River watershed. However, the need for monitoring information remains as strong as ever. Entities involved in monitoring and the entities using the monitoring information agreed it would be useful to collaborate to achieve efficiencies in current and anticipated monitoring efforts to ensure that collected flow and water quality information satisfies both individual project needs as well as those mandated by state and federal agencies. An effort is underway to develop a regional monitoring program for the San Joaquin River watershed. Stakeholders that generate and/or use water quality monitoring data are encouraged to participate. (SWRCB. 2012a).

Ground Water

The Central Valley Water Board has regulatory programs meant to prevent groundwater contamination by controlling the quality of discharges to land. In cases where groundwater quality has been affected, the Water Board's Cleanup programs work with the entities responsible for the contamination to assess the extent of contamination, and develop and implement a plan to clean up the contamination. The Central Valley Water Board has developed programs that regulate specific discharge types when there are a large number of dischargers of that type and the water quality of the discharge is similar. The following are programs addressing specific discharge types (CVRWQCB. 2010b):

- The Confined Animal Program regulates discharges from confined animal operations which are typically high in salt and nutrients. In 2007, the Central Valley Water Board adopted Waste Discharge Requirements General Order for Existing Milk Cow Diaries (R5-2007-0035) which includes requirements for both the dairy production area and land application area and requires each dairy to fully implement their Waste Management Plan by 2011 and Nutrient Management Plan by 2012. The requirements for the Waste and Nutrient Management Plans are designed to protect both surface and ground water. In the San Joaquin River Hydrologic Region, there are 739 dairies with over 658 thousand cows regulated under this general order.
- The Irrigated Lands Regulatory Program, which has been focused on surface water, has been transitioning to a long-term program that will address both surface and groundwater. Irrigated

lands may be a source of salt, nitrates and pesticides to ground water.

- The State Water Board has adopted regulations for the operation of onsite wastewater treatment systems. (Resolution No. 2012-0032). Water quality concerns associated with individual disposal systems include salt, nitrates and pathogens. The Central Valley Water Board plans to update its guidelines and establish a program based on the new regulations. In the past, the Central Valley Water Board has prohibited discharge in problematic service areas. In the San Joaquin River Hydrologic Region, the Central Valley Water Board has adopted thirteen prohibitions of discharge from individual sewage disposal systems. Currently, all of these areas are served by community sewage systems.

Accomplishments

Recent Initiatives to Improve Water Quality

The Central Valley Water Board recently adopted and implemented a basin plan control program that included total maximum daily loads to address mercury in the Delta. The Central Valley Water Board implemented previously adopted basin plan control programs to address salt and boron in the San Joaquin River at Vernalis, selenium in the San Joaquin River, diazinon and chlorpyrifos in the San Joaquin River and the Delta, and dissolved oxygen in the Stockton Deep Water Ship Channel. Improvements in water quality allowed for the CWA 303(d) de-listings for selenium for the San Joaquin River from Merced River to the Delta. The Central Valley Water Board approved the Groundwater Quality Protection Strategy and Workplan to establish a long-term strategy that will identify high priority activities (CVRWQCB. 2010b).

Through the Irrigated Lands Regulatory Program, dischargers have addressed pH, diazinon and toxicity in Duck Slough, dieldrin in French Camp Slough, copper and lead in Grant Line Canal, dissolved oxygen and copper in the Mokelumne River, toxicity in Terminous Tract Drain, and diuron, oryzalin, EC and TDS in the Modesto Irrigation District. (CVRWQCB. 2012a). Also, the Irrigated Lands Program has transitioned from an interim program that imposes requirements on discharges from irrigated lands to surface waters of the State to the long-term program that addresses discharges to both surface and ground waters of the State including increased enforcement for dischargers that create conditions of pollution or nuisance.

The Central Valley Water Board has successfully implemented its general order for existing milk cow dairies and over 95% of the dairies in the San Joaquin River Hydrologic Region are in compliance with the general order.

In addition, the Central Valley Water Board has successfully made improvements to its land discharge program to increase groundwater monitoring and reduce the backlog of waste discharge requirements.

- Under the South County Water Supply Program, South San Joaquin Irrigation District (SSJID) in cooperation with local cities built a treatment plant at Woodward Reservoir which was dedicated in 2005. Treated water from the Stanislaus River is delivered to Manteca, Tracy, and Lathrop. The water supply program is expanding under Phase 2, and treated water is anticipated for Escalon in 2012. On 14 acres adjacent to the water treatment plant, SSJID intends to construct solar panels to provide power for the plant and other purposes.
- The Modesto Regional Water Treatment Plant was completed in 1994 and is operated by Modesto Irrigation District. Treated water from the Tuolumne River is delivered to the City of

Modesto to supplement groundwater supplies. An expansion of the treatment plant is under way including storage and pipeline facilities for the City of Modesto.

- Turlock Irrigation District is proposing to build a surface water treatment plant. Its Regional Surface Water Supply Project would treat Tuolumne River water and deliver it in Stanislaus County to Ceres, Hughson, Keyes, South Modesto, and Turlock. The final environmental impact report is dated December 2006.
- The City of Stockton designed a project to treat Delta water for municipal supply. The Delta Water Supply Project takes surface water from the west side of Empire Tract and transports it approximately six miles eastward along Eight Mile Road to the new treatment plant. The project was completed in 2012. The Delta Water Supply Project Intake and Pump Station Facility is funded in part thanks to a $12.5M Proposition 84 Grant from the State of California, Department of Water Resources under the Safe Drinking Water, Water Quality and Supply, Flood Control, River, and Coastal Protection Bond Act of 2006.
- Yosemite Spring Park Utility Company's plan to make a number of improvements, which include replacing existing water meters with an automatic meter reading system to better record usages and identify water losses due to customer side leaks; replacing failing infrastructure to preserve the integrity and safety of the water supply and reduce to loss of water due to catastrophic failures in the distribution system; constructing a uranium removal system to recover well(s) lost due to detected uranium levels above the drinking water standard; and constructing a surface water treatment plant to provide alternate supply source for Yosemite Lakes Park.

Ecosystem Restoration

A host of other environmental water issues within the region require attention: water quality, water temperature, salinity, and dissolved oxygen sufficient for fish and habitat and other uses are of concern as is the availability of water to supply habitat areas. Environmental water issues and activities within the region include:

- Vernalis Adaptive Management Program
- Central Valley Project Improvement Act
- Anadromous Fish Restoration Program
- Riparian Habitat Protection Program
- Spawning Gravel Replenishment Program
- Refuge Water Supply
- Central Valley Joint Venture
- San Joaquin River Restoration Program

Vernalis Adaptive Management Program

VAMP is a large-scale, long-term (12-year), experimental/management program initiated in 2000 that is designed to protect juvenile Chinook salmon migrating from the San Joaquin River through the Delta. VAMP is also a scientifically recognized experiment to determine how salmon survival rates change in response to alterations in San Joaquin River flows and SWP/CVP exports with the installation of the Head of Old River Barrier. For more information, visit http://www.sjrg.org/default.html.

Central Valley Project Improvement Act

The CVPIA, passed by Congress in 1992, requires the Secretary of the Interior to implement a wide variety of CVP operation modifications and structural repairs in the Central Valley for the benefit of the wildlife and anadromous fish resources, including the goal of a sustainable level of natural anadromous fish production of at least twice the levels from 1967 to 1991. This is in addition to the Anadromous Fish Restoration Program and Anadromous Fish Screening Program. Provisions within the CVPIA address operational improvements to support fisheries restoration through a combination of timed increases in flows; water banking, conservation, and transfers; and modified operations and new or improved control structures.

One of the primary effects of the CVPIA was the dedication of project yield for fish and wildlife purposes. The combined total amount of water dedicated to the environment by the CVPIA suggests an annual amount of up to 1.2 million acre-feet, including reallocation of 800 thousand acre-feet [called (b)(2) water] and dedicated deliveries to wildlife refuges of about 250 thousand acre-feet (called Level 2 Refuge water-see Table SJR-9 above for CVP deliveries to refuges within the San Joaquin River region).

Central Valley Joint Venture

Formally organized in 1988, CVJV is one of the original six priority joint ventures formed under the North American Waterfowl Management Plan. It was formerly named the Central Valley Joint Venture Implementation Plan, which focuses on reversing the decline of California wetlands and works collaboratively to protect, restore, and enhance wetlands and associated habitats for waterfowl, shorebirds, water birds, and riparian songbirds. See its Web site at http://www.centralvalleyjointventure.org/

San Joaquin River Restoration Program (SJRRP)

A comprehensive long-term effort to restore flows to the San Joaquin River from Friant Dam to the confluence of Merced River, ensure irrigation supplies to Friant Water Users, and restore a self-sustaining fishery in the river. SJRPP is a direct result of a settlement reached in September 2006 on an 18-year lawsuit to provide sufficient fish habitat in the San Joaquin River below Friant Dam (near Fresno) by the US departments of the Interior and Commerce, the Natural Resources Defense Council, and the Friant Water Users Authority. Federal legislation was reintroduced on January 4, 2007, to authorize federal agencies to implement the settlement. Interim flows began October 1, 2009, and full restoration flows were scheduled to begin no later than January 2014. Initially, salmon were to be reintroduced no later than December 31, 2012, in the upper reaches, but the timeline for introducing salmon into the river was extended by about 3 years to 2016. In the summer of 2012, the USBR pegged the cost of the program at between $892 million and $2 billion. Find more information at the SJRRP Web site at http://www.restoresjr.net/

Challenges

Flooding

Flood management challenges in the San Joaquin River Hydrologic Region include:

- Inadequate accurate and up-to-date FEMA maps
- Inadequate agency alignment and inconsistent agency roles and responsibilities
- Regulatory constraints that prevent maintenance of existing infrastructure
- Undersized and outdated infrastructure
- Inadequate assistance that is needed with developing and monitoring data (Data needed includes aerial images, mapping, river gauges.)

The identified issues were based upon interviews with 25 agencies of varying levels of flood management responsibilities in each county of the hydrologic region. For a list of agencies with flood management responsibility in the San Joaquin River Hydrologic Region that participated in these meetings, refer California's Flood Future Report. The information gathered from local agencies was used to help improve the process and better understand the local needs throughout the state.

- Recurrent flooding is a problem in many places in the San Joaquin River region. Providing better protection for lives and property remains the definitive flood management challenge. Some particularly vulnerable locations in the region are at Lathrop, Manteca, Merced, Modesto, Stockton, and at Interstate 5 crossings of Panoche Creek, Orestimba Creek, and Del Puerto Creek. Existing facilities are inadequate on the west side of the San Joaquin River from Orestimba Creek to the Delta and on North Fork Jackson Creek in Jackson. Capacity of leveed waterways of the Lower San Joaquin Levee Project has been reduced by regional subsidence.
- Throughout the state, including this region, urbanization continues, bringing greater runoff due to increases of impervious areas and making retention of flood protection levels a challenging issue. Urbanization often causes increases in erosion and sedimentation. In this region, the embankments of irrigation canals that carry floodwaters through urban areas need to be strengthened.
- Completion of floodplain mapping, both the FEMA FIRMs and the State's complementary Awareness Floodplain Mapping, will provide much needed information for evaluating flood risk. In the San Joaquin River region, a current need is improvement of high-water coordination for the San Joaquin River and tributaries, including Kings River inflow, considering use of coordination agreements, forecast-coordinated operations, and reservoir reoperation.
- Local funding for flood maintenance and construction projects has become more difficult to come by due in large part, to new environmental restrictions/conditions, and in the bigger picture, two particularly tough challenges in the region are overcoming the technical and environmental hurdles associated with increasing the capacity of the San Joaquin River from the Merced River into the Delta and removing Arundo donax and other invasive species that significantly restrict water flows.
- Wildfires, which are predicted to become more frequent due to climate change, may denude steep erodible slopes in canyons and upland areas that are located above urban developments in the foothills and mountainous areas of the region. Ensuing winter rains, which are also predicted to replace snow storms, may threaten these areas not only with high water, but also with debris flows.

Funding

- Securing resources to complete local projects where funding and economic conditions are only sufficient to meet a small percentage of those projects.

Licensing and Infrastructure

- Federal Energy Regulatory Commission (FERC) relicensing of New Exchequer Dam on the Merced River and New Don Pedro Dam on the Tuolumne River.
- Finding resources to construct, repair, and maintain infrastructure.

Water Quality

A major challenge will be the development of the CV-SALTS basin plan amendments within the timeframe set by the State Recycled Water Policy. Without action to improve salts management for the Central Valley, the economic vitality of the region is threatened. A 2009 University of California study found that salts and nitrates are already costing Central Valley residents $544 million annually for treatment and lost production (Howitt, et al. 2009). Increasingly, freshwater supplies will be used to dilute salts, reducing supplies for people and the environment, especially during droughts. (CV-SALTS. 2012a).

In the next five years, the Central Valley Water Board expects to adopt TMDLs and control programs for chlorpyrifos, diazinon and pyrethroid pesticides that will cover most valley floor waters. These TMDLs will address 100 current impairments and provide the framework for addressing future listings. In addition, the Central Valley Water Board is taking the lead in coordinating a multi region/State Water Board effort to develop a statewide mercury TMDL control program for reservoirs.

The dairy industry in the Central Valley has been affected by economic factors such as the variability in milk and feed prices. The cost of complying with the General Order for Existing Milk Cow Dairies can be a disproportionate burden on smaller, less economically competitive dairies. In response, the Central Valley Water Board amended the General Order in April 2009 to allow an additional year for dairies to submit certain elements of the Waste Management Plan. The Central Valley Water Board also approved the Central Valley Dairy Representative Monitoring Program as an alternative to installing individual groundwater monitoring systems at each dairy facility. (CVRWQCB. 2011e).

As the irrigated lands program transitions to addressing groundwater quality, the most significant issues that will be addressed will include establishing the groundwater quality monitoring networks necessary to identify problem areas, assess trends, and evaluate effectiveness of practices. (CVRWQCB. 2011e).

There are thousands of abandoned mines in California and a significant portion is in the Central Valley. Remediation of abandoned mines is very costly and determining responsible parties is difficult. State agencies have insufficient staff resources to identify responsible parties. While any past or present owner of the site is a responsible party, some of the owners may never have mined the site or the owners are not financially viable and are not able to conduct investigations and cleanup activities. Mine waste may even be located on land that was not part of the mined property just because in the past mine waste was commonly discharged wherever it was convenient.

Due to the serious threat of both public safety and environmental hazards posed by abandoned mines, there are many volunteers (“Good Samaritans”) who are interested in helping restore watersheds impaired by abandoned mines. However, the threat of liability pursuant to the Clean Water Act (CWA) and/or the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) discourages such third party cleanups. A volunteer conducting a partial cleanup could become liable for the entire cleanup or could be obligated to obtain a discharge permit which requires compliance with strict water quality standards in streams that are already in violation of these standards. Liability may occur even though the volunteer did not cause the pollution. (USEPA. 2012b).

Timber harvest activities may pose a threat to water quality due to the discharge of sediment, herbicides, petroleum products and increases in surface water temperatures. There are currently several legislative measures and EPA policy decisions being considered that have the potential to add a substantial workload to the program. Pre-project and active operations field inspections by water quality regulatory staff allows for proactively locating sediment sources so that appropriate management measures may be taken to reduce or eliminate those threats though the life of the project. However, funding for state agency oversight has steadily decreased in recent years and further reductions are anticipated that will make implementation of this program challenging. (CVRWQCB. 2011e).

Off-highway vehicle (OHV) use is a popular form of recreation in California. State and federal agencies provide recreational areas for this purpose. These OHV recreation areas need to implement a range of storm water best management practices to protect water quality. Additionally, unauthorized and unmanaged OHV areas can become erosion problems and discharge polluted storm water. With limited resources, maintaining and policing these areas can be a challenge.

A major challenge is the ability of small communities to address water quality issues. Small communities with wastewater treatment plants face increasingly stringent wastewater requirements and have difficulty meeting these requirements due to the cost of compliance. The Central Valley has approximately 600,000 individual onsite disposal systems within its boundaries which collectively discharge approximately 120 million gallons per day to the subsurface. Water quality impacts can occur if these systems are not properly sited or properly maintained. It can be difficult for owners of these systems to fund repairs if these systems fail.

Other water quality issues include:

- Coordinating upper watershed programs to maintain water quality and ecosystems, minimize harmful sedimentation and flooding, and equitably maintain the beneficial use of water.
- Maintaining or improving water quality, water temperature, and dissolved oxygen conditions sufficient for environmental needs.
- Combating saline water intrusion into confined aquifers and the movement of saline groundwater fronts encroaching into useable groundwater.
- Maintaining groundwater quality sufficient to meet rural domestic use.

Drought and Flood Planning

The San Joaquin Valley has traditionally used a combination of surface water and groundwater. The San Joaquin River region has significant surface water resources due to Sierra snowpack and reservoir storage on major eastside rivers. Imported surface water supplies may suffer the highest degree of variability. In years where surface water supplies are significantly reduced, additional groundwater is often used to fill the gap between needs and available surface water.

DWR’s Bulletin 118-80, Ground Water Basins in California, identifies eastern San Joaquin (County), Chowchilla, and Madera subbasins as being in a “critical condition of overdraft.” In these subbasins and others, part of the drought preparedness philosophy is to maintain as much groundwater storage as possible. This can be achieved by intentional recharge, water banking, in-lieu recharge, water transfers, shifts to available surface water, etc. See discussions of resource management strategies in Volume 2 of this Water Plan.

FloodSAFE California is a DWR strategic initiative that seeks a sustainable integrated flood management and emergency response system throughout California that improves public safety; protects and enhances environmental and cultural resources; and supports economic growth by reducing the probability of destructive floods, promoting beneficial floodplain processes, and lowering the damages caused by flooding. FloodSAFE is guiding the development of regional flood management plans, which will encourage regional cooperation in identifying and addressing flood hazards. Regional flood plans will include flood hazard identification, risk analyses, review of existing measures, and identification of potential projects and funding strategies. The plans will emphasize multiple objectives, system resiliency, and compatibility with State goals and IRWM plans.

FloodSAFE is responsible for the Central Valley Flood Management Planning Program, the purpose of which is to improve integrated flood management in the Sacramento and San Joaquin Valleys. The program study area includes the watersheds of the Sacramento and San Joaquin rivers. The program is charged with the development of three documents: (1) the State Plan of Flood Control, describing the flood management facilities, land, programs, conditions, and modes of operation and maintenance for the State-federal flood protection system in the Central Valley, published in the spring of 2010; (2) the Flood Control System Status Report, which assesses the status of facilities in the State Plan of Flood Control, identifying deficiencies, and making recommendations for improvement, was completed in December 2011; and (3) the Central Valley Flood Protection Plan, approved by the Central Valley Flood Protection Board on June 29, 2012, describing a sustainable, integrated flood management plan that reflects a system-wide approach for protecting areas of the Central Valley currently receiving protection from flooding by the existing facilities of the State Plan of Flood Control. Updates of the Central Valley Flood Protection Plan are required every five years.

Drought Contingency Plans

Water Code Sections 10601 et seq. require urban suppliers to prepare and update urban water management plans every five years and serve as a drought preparedness planning tool for the state's larger water systems. As part of UWMP preparation, systems must provide a water shortage contingency analysis that addresses how they would respond to supply reductions of up to 50 percent, and must estimate supplies available to their systems in a single dry year and in multiple dry years. Implementing enhanced water conservation programs and calling for customers to achieve either voluntary or mandatory water use reduction targets are common urban agency drought response actions. For example, during the recent 2007-2009 drought, the City of Stockton urged voluntary conservation, instituted rate increases (surcharges), and restricted outdoor water use. (California's Drought of 2007-2009, An Overview, September 2010).

In 2002 the City of Modesto implemented Stage I of its Water Shortage Contingency Plan, which called for a 10 to 20 percent reduction in water use. The City has remained in Stage I since then. Some of the requested/mandated consumer actions include: outdoor watering is prohibited from 12:00 noon to 7:00 pm, identified water leaks must be repaired within 24 hours, and restaurants are encouraged to serve water only on request.

Looking to the Future

Already being implemented is the Friant Water Users Authority (FWUA)/Natural Resources Defense Council agreement to restore the San Joaquin River, the region's namesake. The agreement was reached in 2006, and on March 30, 2009, President Obama signed Public Law 111-11, the Omnibus Public Land Management Act of 2009 that contains the San Joaquin River Restoration Settlement Act. The Act authorizes implementation of the San Joaquin River Restoration Program. Water deliveries to FWUA members could be reduced by about 15 percent on average, but the program has provisions for recapture of a portion of the water used for restoration. Interim flows began October 1, 2009, and full restoration flows were scheduled to begin no later than January 2014. Salmon were to be reintroduced in the upper reaches no later than December 31, 2012; however, the timeline for introducing salmon into the river was extended to 2016.

Many farmers in the San Joaquin River depend on the Delta for delivery of surface water supplies. In

2009, the Governor and legislature approved a comprehensive water package that included a Delta Governance/Delta Plan. It establishes the framework to achieve the co-equal goals of providing a more reliable water supply to California and restoring and enhancing the Delta ecosystem. The co-equal goals are to be achieved in a manner that protects the unique cultural, recreational, natural resource, and agricultural values of the Delta. In May 2012, the Delta Stewardship Council, charged with developing the Delta Plan, was given the last draft version of the document. After it is adopted by the Council, it will require further public review before it can take regulatory effect.

Additional pressures on Delta deliveries will come from court decisions and new federal agency permits that will further limit how much water is sent south to the San Joaquin Valley and Southern California. In May 2007, US District Judge Oliver W. Wanger found that rules governing the smelt (which is protected as a threatened species under the federal Endangered Species Act and was classified as an endangered species in March under the state ESA) in the Delta were flawed and needed to be rewritten. Both the State and federal water projects have been required to reduce pumping to aid the delta smelt.

The US Fish and Wildlife Service issued new biological opinion in December 2008. In a typical year, the new restrictions could cut SWP deliveries by about 20 to 30 percent. Westlands Water District joined forces with the San Luis & Delta-Mendota Water Authority in March 2009 in an attempt to stop the federal government from enforcing the new biological opinion. In December 2010, Judge Oliver Wanger ruled that while pumping from the Sacramento-San Joaquin Delta hurt the smelt, the restrictions set up to protect the fish were not justified. In May of 2011 Judge Wanger set a deadline of December 2013 for the USFWS to rewrite the biological opinion.

In April 2008, a federal judge rejected the federal government’s biological opinion on the 2004 Operations Criteria and Plan for management of the State and federal water project for endangered winter-run Chinook salmon, spring-run Chinook salmon and Central Valley steelhead. New rules were due in March 2009, but the judge delayed the requirement for three months. In June 2009, the National Marine Fisheries Service (NMFS) released the final biological opinion. It estimated that it would reduce deliveries by the federal and state projects by 330,000 af. In September 2011, Judge Wanger invalidated parts of the biological opinion in a lawsuit brought by water users. The judge sent the biological opinion back for further review and analysis, leaving the biological opinion in force while federal water managers and wildlife agencies make the necessary fixes.

In 1996, in western Merced County in an area known as the Grasslands Drainage Area south of Los Banos, a group of growers led by the San Luis & Delta-Mendota Water Authority began an effort known as the Grasslands Bypass Project that would attempt to eliminate selenium tainted drainage water from entering the San Joaquin River upstream of the confluence with the Merced River. In the years since the project began, it has been able to remove 85 percent of selenium in the drainage water. The project was scheduled to end in 2009, but because selenium remains in the drainage water entering the river, the group requested a 10-year extension on the project, and on December 22, 2009, the Bureau of Reclamation signed a Record of Decision (ROD) for the Grassland Bypass Project to execute a new use agreement with the San Luis & Delta Mendota Water Authority for continued use of the San Luis Drain from January 1, 2010, through December 31, 2019.

This list provides a list of some of the priority areas and needs specific to the San Joaquin River Hydrologic Region from a DFG perspective for California, in relation to California water supply.

- Protect or restore fish habitat through the improvement of fish passage conditions, gravel augmentation, hydrology, fish screens, min/max flow, etc…;
- Restoration of floodplain process, including hydrodynamic process, to benefit listed species;
- Restoration projects that facilitate the improvement of nesting and foraging habitat for listed and migratory bird species;
- Increase food web productivity;
- Development, collection and publication of instream flow data, including recommended instream flow levels and minimum instream flow requirements;
- Restoration of perennial grasslands;
- Reduce predation loss of juvenile fish, including fish entrapment
- Restoration projects that facilitate the increase of populations and improvement of habitat for salmon, especially Coho;
- Restoration or modification to allow for a more natural regime of hydrology and hydraulics;
- Restoration of riparian habitat, including conservation of riparian corridors;
- Restoration projects that facilitate the improvement of aquatic habitat, including deep and shallow open water;
- Restoration of saline emergent wetlands and tidal marshes
- Restoration of tributary creeks and streams;
- Improvements in coordination, management and implementation of watersheds;
- Water quality improvements (sediment, oxygen saturation, pollution, temperature, etc…) to support healthy ecosystems;
- Restoration projects that improve upon existing wetlands, or create new wetlands in appropriate areas;
- And, restoration, preservation, and protection of wildlife corridors.

Future Conditions

Future Water Demands

In this section a description is provided for how future San Joaquin River hydrologic region water demands might change under scenarios organized around themes of growth and climate change described earlier. The change in water demand in the San Joaquin River from 2006 to 2050 is estimated for agriculture and urban sectors under 9 growth scenarios and 13 scenarios of future climate change. The climate change scenarios included the 12 Climate Action Team scenarios described earlier and a 13th scenario representing a repeat of the historical climate (1962-2006) to evaluate a “without climate change” condition.

Urban Demand

Figure SJR-12 shows a box plot of change in urban water demand under 9 growth scenarios for the San Joaquin River region with variation shown across 13 scenarios of future climate including one scenario representing a repeat of the historical climate. A box plot is a graphical representation showing the minimum, 25th percentile, median, 75th percentile, and maximum values. The red dot shows the mean or average value. The change in water demand is the difference between the historical average for 1998 to 2005 and future average for 2043 to 2050. Urban demand is the sum of indoor and outdoor water demand where indoor demand is assumed not to be affected by climate. Outdoor demand, however, is dependent on climate factors like amount of precipitation falling and the average air temperature. Urban demand increased under all 9 growth scenarios tracking with population growth. On average, it increased by about 450 thousand acre-feet under the three low population scenarios, 550 thousand acre-feet under the three current trend population scenarios and about 890 thousand acre-feet under the three high population scenarios when compared to historical average of about 590 thousands-acre-feet. The results show change in future urban water demands are less sensitive to housing density assumptions or climate change than to assumptions about future population growth.

PLACEHOLDER Figure SJR-12 Change in Urban Water Demand

[Any draft tables, figures, and boxes that accompany this text for the public review draft are included at the end of the report.]

Agricultural Demand

Figure SJR-13 shows a box plot of statewide change in agricultural water demand for the San Joaquin River region under 9 growth scenarios with variation shown across 13 scenarios of future climate including one scenario representing a repeat of the historical climate. Agricultural water demand decreases under all future scenarios due to reduction in irrigated lands as a result of urbanization and background water conservation when compared with historical average water demand of about 6350 thousand acre-feet. Under the three low population scenarios, the average reduction in water demand was about 550 thousand acre-feet while it was about 900 thousand acre-feet for the three high population scenarios. For the three current trend population scenarios, this change was about 690 thousand acre-feet. The results show that low density housing would result in more reduction in agricultural demand since more lands are lost under low-density housing than high density housing.

PLACEHOLDER Figure SJR-13 Change in Agricultural Water Demand

[Any draft tables, figures, and boxes that accompany this text for the public review draft are included at the end of the report.]

Integrated Water Management Plan Summaries

Inclusion of the information contained in IRWMP's into the CWP Regional Reports has been a common suggestion by regional stakeholders at the Regional outreach meetings since the inception of the IRWM program. To this end the California Water Plan has taken on the task of summarizing readily available Integrated Water Management Plan in a consistent format for each of the regional reports. This collection of information will not be used to determine IRWM grant eligibility. This effort is ongoing and will be included in the final CWP updates and will include up to 4 pages for each IRWMP in the regional reports.

In addition to these summaries being used in the regional reports we intend to provide all of the summary sheets in one IRWMP Summary "Atlas" as an article included in Volume 4. This atlas will, under one cover, provide an "at-a-glance" understanding of each IRWM region and highlight each region's key water management accomplishments and challenges. The atlas will showcase how the dedicated efforts of individual regional water management groups (RWMGs) have individually and cumulatively transformed water management in California.

All IRWMP's are different in how are organized and therefore finding and summarizing the content in a consistent way proved difficult. It became clear through these efforts that a process is needed to allow those with the most knowledge of the IRWMP's, those that were involved in the preparation, to have input on the summary. It is the intention that this process be initiated following release of the CWP Update 2013 and will continue to be part of the process of the update process for Update 2018. This process will also allow for continuous updating of the content of the atlas as new IRWMP's are released or existing IRWMP's are updated.

As can be seen in Figure SJR-11 there are 11 IRWM planning efforts ongoing in the San Joaquin River Hydrologic Region.

Placeholder Text: At the time of the Public Review Draft the collection of information out of the IRWMP's in the region has not been completed. Below are the basic types of information this effort will summarize and present in the final regional report for each IRWMP available. An opportunity will be provided to those with responsibility over the IRWMP to review these summaries before the reports are final.

Region Description: This section will provide a basic description of the IRWM region. This would include location, major watersheds within the region, status of planning activity, and the governance of the IRWM. In addition, a IRWM grant funding summary will be provided.

Key Challenges: The top five challenges identified by the IRWM would be listed in this section.

Principal Goals/Objective: The top five goals and objectives identified in the IRWMP will be listed in this section.

Major IRWM Milestones and Achievements: Major milestones (Top 5) and achievements identified in the IRWMP would be listed in this section.

Water Supply and Demand: A description (one paragraph) of the mix of water supply relied upon in the region along with the current and future water demands contained in the IRWMP will be provided in this section.

Flood Management: A short (one paragraph) description of the challenges faced by the region and any actions identified by the IRWMP will be provided in this section.

Water Quality: A general characterization of the water quality challenges (one paragraph) will be provided in this section. Any identified actions in the IRWMP will also be listed.

Groundwater Management: The extent and management of groundwater (one paragraph) as described in the IRWMP will be contained in this section.

Environmental Stewardship: Environmental stewardship efforts identified in the IRWMP will be summarized (one paragraph) in this section.

Climate Change: Vulnerabilities to climate change identified in the IRWMP will be summarized (one paragraph) in this section.

Tribal Communities: Involvement with tribal communities in the IRWM will be described (one paragraph) in this section of each IRWMP summary.

Disadvantaged Communities: A summary (one paragraph) of the discussions on disadvantaged communities contained in the IRWMP will be included in this section of each IRWMP summary.

Governance: This section will include a description (less than one paragraph) of the type of governance the IRWM is organized under.

Resource Management Strategies

Volume 3 contains detailed information on the various strategies which can be used by water managers to meet their goals and objectives. A review of the resource management strategies addressed in the available IRWMP's are summarized in Table SJR-19.

PLACEHOLDER Table SJR-19 Resource Management Strategies addressed in IRWMP's in the San Joaquin Hydrologic Region

[Any draft tables, figures, and boxes that accompany this text for the public review draft are included at the end of the report.]

Regional Resource Management Strategies

Central Valley Salinity Alternatives for Long-Term Sustainability

Throughout the Central Valley, participating in the development of salt and nitrate management plans is very important to improving water quality in the region and providing for a sustainable economic and environmental future. The Central Valley Salinity Alternatives for Long-Term Sustainability (CV-SALTS) is a strategic initiative to address problems with salinity and nitrates in the surface and ground waters of the Central Valley. The long-term plan developed under CV-SALTS will identify and require discharger implementation of management measures aimed at the reduction and/or control of major sources of salt and nitrate as well as support activities that will alleviate known impairments to drinking water supplies. As this issue has a wide-ranging impact on the San Joaquin River Hydrologic Region, it is important that all stakeholders be part of the development and have input on the implementation of salt and nitrate management within the San Joaquin river area as part of the CV-SALTS program. For the Central Valley, the only available process to develop the salt and nutrient management plans that are required under state policy is through the CV-SALTS program (SWRCB. 2009).

Groundwater Quality Protection Strategy

To protect groundwater quality, the CVRWQCB approved a strategy which recommends the following actions:

- Develop Salt & Nutrient Management Plan
- Implement Groundwater Quality Monitoring Program
- Implement Groundwater Protection Programs through IRWM Plan Groups
- Broaden Public Participation in all programs
- Coordinate with local agencies to implement a Well Design & Destruction Program
- Creation of a Groundwater Database
- Alternative Dairy Waste Disposal Methods
- Develop individual and general orders for Poultry, Cattle Feedlots and other types of

Concentrated Animal Feeding Operations (CAFOs)
- Implementation of Long-term Irrigated Lands Regulatory Program (ILRP)
- Coordinate with California Department of Food and Agriculture (CDFA) to identify methods to enhance fertilizer program
- Reduce Site Cleanup Backlog
- Draft waiver following new regulation adopted based on AB885 (passed in 2000 and requires the State Water Board to adopt regulations or standards for the operation of onsite wastewater treatment systems (OWTS))
- Update Guidelines for Waste Disposal for Land Developments consistent with the Water Quality Control Policy for Siting, Design, Operation and Maintenance of Onsite Wastewater Treatment Systems (State Water Board Resolution 2012-0032 adopted in compliance with Water Code section 13291)

Salt and Salinity Management

In March 2010, a Memorandum of Agreement (MOA) was finalized between Central Valley Regional Water Quality Control Board, Central Valley Salinity Coalition (a legal stakeholder entity), and the State Water Resources Control Board that documents the roles and responsibilities of the parties to coordinate salinity planning, management and regulation throughout the Central Valley in order to insure a sustainable future. The State Water Board provided $5-million in seed money that is being matched by stakeholder contributions. Some activities completed to date to help develop a sustainable salt and nitrate management plan include: pilot studies to document water balances and salt and nitrate source and fate (between 2009 and 2011), initiation of a management practices tool box that assists dischargers in identifying practices that will help reduce salt and nitrate impacts (2010); initiation of a conceptual model to prioritize management areas for detailed study and implementation plans (2012); and development of a long term funding plan (2012).

South of Delta SWP/CVP aqueduct intertie

A shared federal-state water system improvement project, the Intertie connects the Delta-Mendota Canals (DMC) (federal facility) and the California Aqueduct (CA) (state facility) and pumping station via two 108-inch-diameter pipes. Jones Pumping Plant and the DMC are the primary federal water delivery facilities that provide water to Central Valley Operations (CVP) contractors south of the Bay-Delta. The Intertie provides redundancy in the water distribution system, allows for maintenance and repair activities that are less disruptive to water deliveries, and provides the flexibility to respond to CVP and State Water Project (SWP) emergencies. The contract was awarded in July 2010 and construction was completed in April 2012.

The Intertie will primarily be used in the fall and winter to fill the CVP's San Luis Reservoir earlier in the year to support South-of-Delta allocations. On a long-term annual average basis the Intertie is expected to provide a 35,000 acre-feet increase in CVP deliveries.

The Intertie cost $29 million which includes planning, design, permitting, mitigation, and construction management in addition to the pumping plant and transmission line construction cost. The Intertie was constructed using American Recovery and Reinvestment Act and other federally appropriated funds, as well as water user contributed funds. Federal costs are being recovered from benefitting water contractors according to Reclamation rate-setting policy.

http://www.usbr.gov/mp/PA/docs/fact_sheets/Aquaduct_Delta_Mendota_Intertie.pdf

Madera County water bank

Currently, farmers in MID's service area use a combination of groundwater and surface water. During dry years there is not adequate surface water to meet the water demand and groundwater pumping increases substantially. The amount of groundwater that has been pumped from the aquifer in the vicinity of Madera Ranch has exceeded the amount of water that has recharged the aquifer, resulting in groundwater overdraft. Even in wet years, the groundwater basin is in severe overdraft because groundwater pumping is steadily increasing for agricultural use as well as M&I use. This overdraft has caused the water table to decline and groundwater quality to degrade and has resulted in excess space in the aquifer that could be used to bank surface water. (Madera Irrigation District Water, Supply Enhancement Project, Final Environmental Impact Statement, EIS-06-127).

In the vicinity of Madera Ranch, the water table has declined more than 90 feet over the last 60 years. These conditions have made it increasingly expensive for farmers to pump groundwater. Additionally, in many years, MID has been unable to deliver sufficient surface water to farmers because water is available primarily during the early months of the year when irrigation demand is low, and often water is available only for short periods of time during the growing season. (Madera Irrigation District Water, Supply Enhancement Project, Final Environmental Impact Statement, EIS-06-127).

In 2005 MID acquired the 13,000 acre+ Madera Ranch property that will be used for groundwater banking. The Madera Ranch Water Bank will be able to store up to 250,000 af with recharge/recovery rates of up to 55,000 af per year. The majority of the recharge will be through natural swales and existing unlined canals. Only 323 acres of conventional recharge basins will be built for the project. The purposes of the project are to: enhance water supply reliability and flexibility, reduce groundwater overdraft, reduce groundwater pumping costs, improve groundwater quality, and encourage conjunctive use. (Madera ID Press Release, 8/2/11).

Grasslands Bypass

The Grasslands Bypass Project was established to implement the Basin Plan selenium control program for the San Joaquin River. The Project routes subsurface agricultural drainage water with elevated levels of selenium, salts and other constituents of concern away from wildlife refuges and wetlands. The goal is to reduce and reuse high selenium subsurface agricultural drainage to comply with the Basin Plan load limits for the San Joaquin River and its tributaries.

Between 1998 and 2009, Best Management Practices implemented by Grasslands Area Farmers prevented more than 22,300 pounds of selenium and 80,735 acre-feet of drainage from discharging to waters. These load reductions brought Salt Slough into compliance with the 2.0 μg/L selenium monthly mean objective, and reduced selenium loading in the lower SJR below the four-day average of 5.0 μg/L. As a result, California removed several water bodies from its impaired waters list, including Salt Slough (10 miles) in 2008 and three segments (a combined 40.4 miles) of the SJR— Merced River to Tuolumne River (29 miles), Tuolumne River to Stanislaus River (8.4 miles), and Stanislaus River to the Delta Boundary (3 miles)—in 2010. (USEPA, Section 319, Nonpoint Source Program Success Story, California, Grasslands Bypass Project Reduces Selenium in the San Joaquin Basin, September 2011).

Although the GBP has made significant progress, additional work is required to achieve the ultimate project goal of zero discharge. To this end, Bureau of Reclamation signed a Record of Decision (ROD) on December 22, 2009, for the Grassland Bypass Project to execute a new use agreement with the San Luis & Delta Mendota Water Authority for continued use of the San Luis Drain from January 1, 2010, through December 31, 2019.

Climate Change

For over two decades, the State and federal governments have been preparing for climate change effects on natural and built systems with a strong emphasis on water supply. Climate change is already impacting many resource sectors in California, including water, transportation and energy infrastructure, public health, biodiversity, and agriculture (USGRCP, 2009; CNRA, 2009). Climate model simulations based on the Intergovernmental Panel on Climate Change's 21st century scenarios project increasing temperatures in California, with greater increases in the summer. Projected changes in annual precipitation patterns in California will result in changes to surface runoff timing, volume, and type (Cayan, 2008). Recently developed computer downscaling techniques indicate that California flood risks from warm-wet, atmospheric river type storms may increase beyond those that we have known historically, mostly in the form of occasional more-extreme-than-historical storm seasons (Dettinger, 2011).

Currently, enough data exist to warrant the importance of contingency plans, mitigation (i.e., reduction) of greenhouse gas (GHG) emissions, and incorporating adaptation strategies (i.e., methodologies and infrastructure improvements that benefit the region at present and into the future). While the State of California is taking aggressive action to mitigate climate change through reducing emissions from greenhouse gases and implementing other measures (CARB, 2008), global impacts from carbon dioxide and other GHGs that are already in the atmosphere will continue to impact climate through the rest of the century (IPCC, 2007).

Resilience to an uncertain future can be achieved by implementing adaptation measures sooner rather than later. Due to the economic, geographical and biological diversity of the state, vulnerabilities and risks due to current and future anticipated changes are best assessed on a regional basis. Many resources are available to assist water managers and others in evaluating their region-specific vulnerabilities and identifying appropriate adaptive actions (EPA/DWR, 2011; Cal-EMA/CNRA, 2012).

Observations

The region's observed temperature and precipitation vary greatly due to complex topography. Regionally-specific temperature observations can be retrieved through the Western Regional Climate Center (WRCC)*.Three WRCC regions overlap with the San Joaquin River Hydrologic Region - the Sierra, Sacramento-Delta, and San Joaquin Valley regions. Temperatures in the WRCC Sacramento-Delta region during the period of record indicate that a mean increase of about 1.5-2.4 °F (0.8 -1.3 °C) has occurred, with minimum values increasing more than maximums [2.1-3.1 °F (1.2-1.7 °C) and 0.7-1.9 °F (0.4-1.1 °C), respectively]. Temperatures in the WRCC San Joaquin Valley region show a similar trend. A mean increase of 0.9-1.9 °F (0.5-1.0 °C) was recorded, with minimum temperatures increasing 2-3 °F (1.1-1.6 °C) compared to the mean maximum temperature trend, which was relatively stable. The WRCC Sierra region also had an increasing mean temperature trend of 0.8-1.9 °F (0.4-1.1 °C), and again more warming was observed at night than in daytime [1.7-2.7 °F (0.9-1.5 °C) compared to -0.3-1.3 °F (-0.2-0.7 °C)].

The San Joaquin River Region also is currently experiencing impacts from climate change through changes in statewide precipitation and surface runoff volumes, which in turn affect availability of local and imported water supplies. During the last century, the average early snowpack in the Sierra Nevada decreased by about ten percent, which equates to a loss of 1.5 million acre-feet of snowpack storage (DWR, 2008).

Projections and Impacts

While historic data is a measured indicator of how the climate is changing, it can't project what future conditions may be like under different GHG emissions scenarios. Current climate science uses modeling methods to simulate and develop future climate projections. A recent study by Scripps Institution of Oceanography uses the most sophisticated methodology to date, and indicates that by 2060-2069, temperatures will be 3.4 -4.9oF (1.9 -2.7oC) higher across the state than they were from 1985 to1994 (Pierce et al, 2012). By 2060-29, the annual mean temperature in the San Joaquin River region is projected to increase by 4.1 °F (2.3 °C) for the annual mean, with an increase of 3.2 °F (1.8 °C) in mean winter temperatures and 5.2 °F (2.9 °C) in summer . Two or three additional heat waves, defined as five days over 102 °F, are expected annually by 2050, with five to eight more by 2100 (Cal-EMA/CNRA, 2012). Climate projections for the San Joaquin region from Cal-Adapt indicate that the temperatures between 1990 and 2100 are projected to increase 7-10°F (3.9 - 5.6°C) during winter and 9 -11°F (5-6.1°C) during summer (Cal-EMA and CNRA, 2012b).

Changes in annual precipitation across California, either in timing or total amount, will result in changes to the type of precipitation (rain or snow) in a given area and to the timing and volume of surface runoff. Precipitation projections from climate models for California are not all in agreement, but most anticipate drier conditions in the southern part of California, with heavier and warmer winter precipitation in the north (Pierce, et al., 2012). Because there is less scientific detail on localized precipitation changes, there exists a need to adapt to this uncertainty at the regional level (Qian, et al., 2010).

The Sierra Nevada snowpack is expected to continue to decline as warmer temperatures raise the elevation of snow levels, reduce spring snowmelt, and increase winter runoff. Based upon historical data and modeling, researchers at Scripps Institution of Oceanography project that, by the end of this century, the Sierra snowpack will experience a 48 to 65 percent loss from its average at the end of the previous century(van Vuuren et al., 2011). In addition, earlier seasonal flows will reduce the flexibility in how the state manages its reservoirs to protect communities from flooding while ensuring a reliable water supply.

A recent study that explores future climate change and flood risk in the Sierra using downscaled simulations (computer projections refined to a scale smaller than global models), from three global climate models (GCMs) under a GHG scenario which is reflective of current trends, indicates a tendency toward increased 3-day flood magnitude. By the end of the 21st century, all three projections yield larger floods for both the moderate elevation northern Sierra Nevada watershed and for the high elevation southern Sierra Nevada watershed, even for GCM simulations with 8% to 15% declines in overall precipitation. The increases in flood magnitude are statistically significant for all three GCMs for the period 2051–2099. By the end of the 21st century, the magnitudes of the largest floods increase to 110% to 150% of historical magnitudes. These increases appear to derive jointly from increases in heavy precipitation amount, storm frequencies, and days with more precipitation falling as rain and less as snow. (Das et al., 2011).

Changes in climate and runoff patterns may create increased competition among sectors that utilize water.

Currently, Delta pumping restrictions are in place to protect endangered aquatic species. Climate change is likely to further constrain the management of these endangered species and the state's ability to provide water for other uses. The region is economically dependent on the thriving agricultural industry, which will be affected by a more variable hydrologic regime, reduced chill-hours in winter, increased evapotranspiration, and other indirect effects of rising temperatures. In some instances a longer growing season will be beneficial, but productivity of stone-fruit and nut trees may decline. The dairy industry will be affected by an anticipated increase in extreme heat days and reduced water availability (CNRA, 2012). Agricultural water use efficiency will become increasingly important under these conditions. Additional climate change impacts will occur in surrounding watersheds. Wildfires in the Sierra foothills may increase in number and intensity (Westerling, 2008), impacting habitat and water quality in the San Joaquin River region.

Adaptation

Changes in climate have the potential to impact the region, upon which the State depends for its economic and environmental benefits. These changes will increase the vulnerability of natural and built systems in the region. Impacts to natural systems will challenge aquatic and terrestrial species by diminishing water quantity and quality and shifting eco-regions. Built systems will be impacted by changing hydrology and runoff timing, loss of natural snowpack storage, making the region more dependent on surface storage in reservoirs and groundwater sources. Preparing for increased future water demand for both natural and built systems may be particularly challenging with less natural storage and less overall supply.

The San Joaquin River Hydrologic Region contains a diverse landscape with different climate zones, making it difficult to find one-size-fits-all adaptation strategies. Water managers and local agencies must work together to determine the appropriate planning approach for their operations and communities. While climate change adds another layer of uncertainty to water planning, it does not fundamentally alter the way water managers already address uncertainty (USEPA and DWR, 2011). However, stationarity (the idea that natural systems fluctuate within an unchanging envelope of variability) can no longer be assumed, so new approaches will likely be required (Milly, et.al., 2008).

Integrated Regional Water Management (IRWM) planning is a framework that allows water managers to address climate change on a smaller, more regional scale. Climate change is now a required component of all IRWM plans (DWR, 2010). IRWM regions must identify and prioritize their specific vulnerabilities, and identify adaptation strategies that are most appropriate for sub-regions. Planning strategies to address vulnerabilities and adaptation to climate change should be both proactive and adaptive, starting with strategies that benefit the region in the present-day while adding future flexibility and resilience under uncertainty.

Local agencies, as well as federal and state agencies, face the challenge of interpreting climate change data and determining which methods and approaches are appropriate for their planning needs. The Climate Change Handbook for Regional Water Planning (EPA/DWR, 2011) provides an analytical framework for incorporating climate change impacts into a regional and watershed planning process and considers adaptation to climate change. This handbook provides guidance for assessing the vulnerabilities of California's watersheds and regions to climate change impacts, and prioritizing these vulnerabilities.

The State of California has developed additional tools and resources to assist resource managers and local agencies in adapting to climate change, including:

- *California Climate Adaptation Strategy (2009)* - California Natural Resources Agency (CNRA) at: http://www.climatechange.ca.gov/adaptation/strategy/index.html
- *California Climate Change Adaptation Planning Guide (2012)* - California Emergency Management Agency (Cal-EMA) and CNRA at: http://resources.ca.gov/climate_adaptation/local_government/adaptation_planning_guide.html
- *Cal-Adapt website* at: http://cal-adapt.org/
- *Urban Forest Management Plan (UFMP) Toolkit* - sponsored by the California Department of Forestry and Fire Management at: http://ufmptoolkit.com/
- *California Climate Change Portal* at: http://www.climatechange.ca.gov/
- *DWR Climate Change* website at: http://www.water.ca.gov/climatechange/resources.cfm
- *The Governor's Office of Planning and Research (OPR)* website at: http://www.opr.ca.gov/m_climatechange.php

Many of the Resource Management Strategies from California Water Plan Update 2009 (Volume 3) provide benefits for adapting to climate change in addition to meeting water management objectives. These include:

- Agricultural/Urban Water Use Efficiency;
- Conveyance – Regional/local;
- System Reoperation;
- Conjunctive Management and Groundwater Storage;
- Precipitation Enhancement;
- Surface Storage – Regional/Local;
- Pollution Prevention;
- Agricultural Land Stewardship;
- Ecosystem Restoration;
- Forest Management;
- Land Use Planning and Management;
- Recharge Area Protection;
- Watershed Management
- Flood Risk and Integrated Flood Management

The myriad of resources and choices available to managers can seem overwhelming, and the need to take action given uncertain future conditions is daunting. However, there are many actions that water managers in the San Joaquin River region can take to prepare for climate change, regardless of the magnitude of future warming. These actions often provide economic and public health co-benefits. Water and energy conservation are examples of strategies that make sense with or without the additional pressures of climate change. Promoting healthy urban forests can reduce the urban heat island effect by decreasing ambient air temperature. Restoration of flood control and riparian corridors is an important adaptation strategy for both water management flexibility and ecosystem protection. Conjunctive management projects that manage surface and groundwater in a coordinated fashion could provide a buffer against variable annual water supplies. Forecast-coordinated operations would provide flexibility for water managers to respond to weather conditions as they unfold.

Regardless of the specific strategies selected, increased coordination across sectors will be imperative for successful climate adaptation. Water managers will need to consider both the natural and built environments as they plan for the future. Stewardship of natural areas and protection of biodiversity are critical for maintaining ecosystem services important for human society such as carbon sequestration, pollution remediation, and habitat for pollinators. Increased cross-sector collaboration between water managers, land use planners and ecosystem managers provides opportunities for identifying common goals and actions needed to achieve resilience to climate change and other stressors.

Mitigation

California's water sector has a large energy footprint, consuming 7.7% of statewide electricity (CPUC, 2010). Energy is used in the water sector to extract, convey, treat, distribute, use, condition, and dis-pose of water. Figure 3-26, Water-Energy Connection in Volume 1, CA Water Today shows all of the connections between water and energy in the water sector; both water use for energy generation and energy use for water supply activities. The regional reports in the 2013 California Water Plan Update are the first to provide detailed information on the water-energy connection, including energy intensity (EI) information at the regional level. This EI information is designed to help inform the public and water utility managers about the relative energy requirements of the major water supplies used to meet demand. Since energy usage is related to Greenhouse Gas (GHG) emissions, this information can support measures to reduce GHG's, as mandated by the State.

Figure SJR-14 shows the amount of energy associated with the extraction and conveyance of 1 acre-foot of water for each of the major sources in this region. The quantity used is also included, as a percent. For reference, Figure 3-26, Water-Energy Connection in CA Water Today, Volume 1 highlights which water-energy connections are illustrated in Figure SJR-14; only extraction and conveyance of raw water. Energy required for water treatment, distribution, and end uses of the water are not included. Not all water types are available in this region. Some water types flow by gravity to the delivery location and therefore do not require any energy to extract or convey (represented by a white light bulb).

Recycled water and water from desalination used within the region are not show in Figure SJR-14 because their energy intensity differs in important ways from those water sources. The energy intensity of both recycled and desalinated water depend not on regional factors but rather on much more localized, site, and application specific factors. Additionally, the water produced from recycling and desalination is typically of much higher quality than the raw (untreated) water supplies evaluated in Figure SJR-14. For these reasons, discussion of energy intensity of desalinated water and recycled water are included in Volume 3, Resource Management Strategies.

Energy intensity, sometimes also known as embedded energy, is the amount of energy needed to extract and convey (extraction refers to the process of moving water from its source to the ground surface. Many water sources are already at ground surface and require no energy for extraction, while others like groundwater or sea water for desalination require energy to move the water to the surface. Conveyance refers to the process of moving water from a location at the ground surface to a different location, typically but not always a water treatment facility. Conveyance can include pumping of water up hills and mountains or can occur by gravity) an acre-foot of water from its source (e.g. groundwater or a river) to a delivery location, such as a water treatment plant or a State Water Project (SWP) delivery turnout . Energy intensity should not be confused with total energy—that is, the amount of energy (e.g. kWh) required to deliver all of the water from a water source to customers within the region. Energy intensity focuses not on the total amount of energy used to deliver water, but rather the energy required to deliver a single unit of water (in kWh/acre-foot). In this way, energy intensity gives a normalized metric which can be used to compare alternative water sources.

In most cases, this information will not be of sufficient detail for actual project level analysis. However, these generalized, region-specific metrics provide a range in which energy requirements fall. The information can also be used in more detailed evaluations using tools such as WeSim (http://www.pacinst.org/publication/wesim/) which allows modeling of water systems to simulate outcomes for energy, emissions, and other aspects of water supply selection. It's important to note that water supply planning must take into consideration a myriad of different factors in addition to energy impacts; costs, water quality, opportunity costs, environmental impacts, reliability and other many other factors.

Energy intensity is closely related to Greenhouse Gas (GHG) emissions, but not identical, depending on the type of energy used (see CA Water Today, Water-Energy, Volume 1). In California, generation of 1 megawatt-hour (MWh) of electricity results in the emission of about 1/3 of a metric ton of GHG, typically referred to as carbon dioxide equivalent or CO2e (eGrid, 2012). This estimate takes into account the use of GHG-free hydroelectricity, wind, and solar and fossil fuel sources like natural gas and coal. The GHG emissions from a specific electricity source may be higher or lower than this estimate.

Reducing GHG emissions is a State mandate. Water managers can support this effort by considering energy intensity factors, such as those presented here, in their decision making process. Water use efficiency and related best management practices can also reduce GHGs (See Volume 2, Resource Management Strategies).

Accounting for Hydroelectric Energy

Generation of hydroelectricity is an integral part of many of the state's large water projects. In 2007, hydroelectric generation accounted for nearly 15% of all electricity generation in Californi a. The State Water Project, Central Valley Project, Los Angeles Aqueduct, Mokelumne Aqueduct, and Hetch Hetchy Aqueducts all generate large amounts of hydroelectricity at large multi-purpose reservoirs at the heads of each system. In addition to hydroelectricity generation at head reservoirs, several of these systems also generate hydroelectric energy by capturing the power of water falling through pipelines at in-conduit generating facilities (In-conduit generating facilities refer to hydroelectric turbines that are placed along pipelines to capture energy as water runs down hill in a pipeline (conduit). Hydroelectricity is also generated at hundreds of smaller reservoirs and run-of-the-river turbine facilities.

Hydroelectric generating facilities at reservoirs provide unique benefits. Reservoirs like the State Water Project's Oroville Reservoir are operated to build up water storage at night when demand for electricity is low, and release the water during the day time hours when demand for electricity is high. This operation, common to many of the state's hydropower reservoirs, helps improve energy grid stabilization and reliability and reduces GHG emissions by displacing the least efficient electricity generating facilities. Hydroelectric facilities are also extremely effective for providing back-up power supplies for intermittent renewable resources like solar and wind power. Because the sun can unexpectedly go behind a cloud or the wind can die down, intermittent renewables need back up power sources that can quickly ramp up or ramp down depending on grid demands and generation at renewable power installations.

Despite these unique benefits and the fact that hydroelectric generation was a key component in the formulation and approval of many of California's water systems, accounting for hydroelectric generation in energy intensity calculations is complex. In some systems like the SWP and CVP, water generates electricity and then flows back into the natural river channel after passing through the turbines. In other systems like the Mokelumne aqueduct water can leave the reservoir by two distinct out flows, one that generates electricity and flows back into the natural river channel and one that does not generate electricity and flows into a pipeline flowing into the East Bay Municipal Utility District service area. In both these situations, experts have argued that hydroelectricity should be excluded from energy intensity calculations because the energy generation system and the water delivery system are in essence separate (Wilkinson, 2000).

DWR has adopted this convention for the energy intensity for hydropower in the regional reports. All hydroelectric generation at head reservoirs has been excluded from Figure SJR-14. Consistent with Wilkin-son (2000) and others, DWR has included in-conduit and other hydroelectric generation that occurs as a consequence of water deliveries, such as the Los Angeles Aqueduct's hydroelectric generation at San Francisquito, San Fernando, Foothill and other power plants on the system (downstream of the Owen's River Diversion Gates). DWR has made one modification to this methodology to simplify the display of results: energy intensity has been calculated at each main delivery point in the systems; if the hydroelectric generation in the conveyance system exceeds the energy needed for extraction and conveyance, the energy intensity is reported as zero (0). I.e., no water system is reported as a net producer of electricity, even though several systems do produce more electricity in the conveyance system than is used (e.g., Los Angeles Aqueduct, Hetch Hetchy Aqueduct). (For detailed descriptions of the methodology used for the water types presented, see Technical Guide, Volume 5).

PLACEHOLDER Figure SJR-14 Energy Intensity of Raw Water Extraction and Conveyance in the San Joaquin Hydrologic Region

[Any draft tables, figures, and boxes that accompany this text for the public review draft are included at the end of the report.]

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Additional References

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Table SJR-1 Critical Species in the San Joaquin River Hydrologic Region

Category	Common name	Scientific name	Federal status [a]	State status [a]
Invertebrates	Lange's metalmark butterfly	*Apodemia mormo langei*	FE	
	Conservancy fairy shrimp	*Branchinecta conservatio*	FE	
	Longhorn fairy shrimp	*Branchinecta longiantenna*	FE	
	San Bruno elfin butterfly	*Callophrys mossii bayensis*	FE	
	Vernal pool tadpole shrimp	*Lepidurus packardi*	FE	
Fish	Delta smelt	*Hypomesus transpacificus*	FT	SE
Amphibians	Sierra Nevada yellow-legged frog	*Rana sierrae*	FC	SCE
Reptiles	Blunt-nosed leopard lizard	*Gambelia sila*	FE	SE
Birds	Golden eagle	*Aquila chrysaetos*		FP
	Western yellow-billed cuckoo	*Coccyzus americanus occidentalis*	FC	SE
	White-tailed kite	*Elanus leucurus*		FP
	Willow flycatcher	*Empidonax traillii*		SE
	American peregrine falcon	*Falco peregrinus anatum*		FP
	Bald eagle	*Haliaeetus leucocephalus*		SE, FP
	Great gray owl	*Strix nebulosa*		SE
	Least Bell's vireo	*Vireo bellii pusillus*	FE	SE
Mammals	Giant kangaroo rat	*Dipodomys ingens*	FE	SE
	Fresno kangaroo rat	*Dipodomys nitratoides exilis*	FE	SE
	Riparian (=San Joaquin Valley) woodrat	*Neotoma fuscipes riparia*	FE	
	Salt-marsh harvest mouse	*Reithrodontomys raviventris*	FE	SE
	Riparian brush rabbit	*Sylvilagus bachmani riparius*	FE	SE
	San Joaquin kit fox	*Vulpes macrotis mutica*	FE	ST

Note:

a State and Federal Designations:

SE = State-listed as Endangered
ST = State-listed as Threatened
FP = Fully Protected under the CA Dept. of Fish & Game
FE = Federally-listed as Endangered
FT = Federally-listed as Threatened
SCE = Candidate for State Listing as Endangered
FC = Candidate for Federal Listing

Table SJR-2 Critical Plant Species Endemic to the San Joaquin River Hydrologic Region

Common Name	Scientific Name	Federal Status [a]	State Status [a]	CNPS Rank [b]
Antioch Dunes buckwheat	*Eriogonum nudum var. psychicola*			1B.1
Chinese Camp brodiaea	*Brodiaea pallida*	FT	ST	1B.1
Contra Costa wallflower	*Erysimum capitatum var. angustatum*	FE	SE	1B.1
Delta button-celery	*Eryngium racemosum*			1B.1
El Dorado bedstraw	*Galium californicum ssp. sierrae*	FE	SR	1B.2
Ione buckwheat	*Eriogonum apricum var. apricum*	FE	SE	1B.1
Irish Hill buckwheat	*Eriogonum apricum var. prostratum*	FE	SE	1B.1
Large-flowered fiddleneck	*Amsinckia grandiflora*	FE	SE	1B.1
Lime Ridge navarretia	*Navarretia gowenii*			1B.1
Mariposa pussypaws	*Calyptridium pulchellum*	FT		1B.1
Merced clarkia	*Clarkia lingulata*		SE	1B.1
Pine Hill ceanothus	*Ceanothus roderickii*	FE	SR	1B.2
Red Hills vervain	*Verbena californica*	FT	ST	1B.1
Sacramento Orcutt grass	*Orcuttia viscida*	FE	SE	1B.1
Stebbins' lomatium	*Lomatium stebbinsii*			1B.1
Succulent owl's-clover	*Castilleja campestris ssp. succulenta*	FT	SE	1B.2

Notes:

[a] State and Federal Designations:
SE = State-listed as Endangered
ST = State-listed as Threatened
SR = State-listed as Rare
FE = Federally-listed as Endangered
FT = Federally-listed as Threatened

[b] California Native Plant Society (CNPS) Ranks:
1A = Plants Presumed Extinct in California
1B.1 = Plants Rare, or Seriously Threatened or Endangered in CA and elsewhere
1B.2 = Plants Rare, or Fairly Threatened or Endangered in CA and elsewhere

Table SJR-3 San Joaquin River Hydrologic Region Population by County for 2005 and 2010

County	2005 population	2010 population
Alameda	412	403
Contra Costa	191,096	211,304
San Joaquin	651,625	685,306
Amador	37,632	38,030
Calaveras	44,773	45,578
Sacramento	43,326	45,409
Alpine	129	121
El Dorado	59,224	65,212
Tuolumne	56,452	55,365
Madera	139,868	150,865
Merced	240,600	255,793
Stanislaus	498,020	514,453
Mariposa	18,057	18,251
Fresno	17,794	18,116
Total	1,999,008	2,104,206

Table SJR-4 Top 10 Most Populous Cities within the San Joaquin River Hydrologic Region

City	Population
Stockton	291,707
Modesto	201,165
Antioch	102,372
Tracy	82,922
Merced	78,958
Turlock	68,549
Manteca	67,096
Lodi	62,134
Pittsburg	63,264
Madera	61,416

Table SJR-5 Federally Recognized Tribes in the San Joaquin River Hydrologic Region

Name of Tribe	Acres	Cultural Affiliation	County of location
Shingle Springs Rancheria	160	Maidu, Miwok	El Dorado
Jackson Rancheria	331	Mewuk (Miwok)	Amador
Buena Vista Rancheria	67	Miwok (Mewuk)	Amador
Tuolumne Rancheria	335	Me-Wuk, Miwok, Yokut	Tuolumne
Chicken Ranch Rancheria	3	Me-Wuk	Tuolumne
Picayune Rancheria	160	Chukchansi	Madera
North Fork Rancheria	80	Western Mono	Madera
Big Sandy Rancheria	228	Western Mono (Monache) Indians	Fresno
Table Mountain Rancheria	61	Yokuts	Fresno
California Valley Miwok Tribe	Unknown	Miwok	Calaveras
Ione Band of Miwok Indians of California	228	Miwok	Amador

Note:
As per data taken from the San Diego State University's online library and information access (http://infodome.sdsu.edu/research/guides/calindians/calinddict.shtml#a) and Wikipedia.org

Table SJR-6 Tribes within Integrated Regional Water Management Regions in the San Joaquin River Hydrologic Region

Map No.	IRWM	Tribe
1	American River	Wilton Rancheria
4	Yosemite-Mariposa	No Tribes in this IRWM Region
6	Cosumnes American Bear Yuba (CABY)	Shingle Springs Band of Miwok Indians
7	East Contra Costa County	No Tribes in this IRWM Region
8	Eastern San Joaquin	No Tribes in this IRWM Region
16	Madera	Picayune Rancheria of Chukchansi Indians
17	Merced	No Tribes in this IRWM Region
19	Mokelumne/Amador/Calaveras	Buena Vista Rancheria Me-Wuk Indians of California
		California Valley Miwok Tribe
		Ione Band of Miwok Indians
33	Southern Sierra	Big Sandy Rancheria of Mono Indians of California
		Table Mountain Rancheria of California
36	Tuolumne-Stanislaus	Chicken Ranch Rancheria of Me-wuk
		Tuolumne Band of Me-Wuk Indians
44	Westside-San Joaquin	No Tribes in this IRWM Region
47	East Stanislaus	No Tribes in this IRWM Region

Table SJR-7 Disadvantaged Communities (Cities) within the San Joaquin River Hydrologic Region

City	Population	Median Household Income
Firebaugh	7,373	$30,000
Sonora	4,914	$30,893
Plymouth	903	$31,250
Merced	77,080	$36,269
Chowchilla	18,090	$39,902
Dos Palos	4,904	$40,121
Angels	3,790	$40,690
Gustine	5,438	$40,818
Madera [a]	59,006	$40,889
Atwater	27,587	$42,226
Livingston	12,733	$46,198
Jackson	4,625	$46,932
Newman	9,806	$47,416
Sutter Creek	2,827	$47,909
Stockton	287,377	$47,946
Lodi	62,225	$48,695

Note:

[a] Madera city excluding Bonadelle Ranchos-Madera Ranchos.

Table SJR-8 Poorest 20 Census Designated Places within the San Joaquin River Hydrologic Region with Populations Greater Than 2,000

Census Place	Population	MHI
Shackelford	3,748	$19,302
South Dos Palos	2,271	$28,931
Winton	11,103	$29,586
Firebaugh [a]	7,373	$30,000
August	8,332	$30,469
West Modesto	6,222	$30,767
Sonora [a]	4,914	$30,893
Empire	3,763	$32,198
Columbia	2,504	$33,494
Jamestown	3,684	$33,988
Bystrom	4,010	$34,464
Keyes	5,079	$35,130
Oakhurst	3,263	$35,155
Kennedy	3,293	$35,450
Planada	4,295	$35,880
Merced [a]	77,080	$36,269
Bethel Island	2,191	$36,515
Parkwood	2,025	$37,208
Bret Harte	5,102	$38,087
Parksdale	2,977	$38,895

Note:

[a] All are Census Designated Places, except Firebaugh, Sonora, and Merced, which are cities.

Table SJR-9 Central Valley Project Supplies for Select Wildlife Refuges in the San Joaquin River Region

Refuge	CVP Deliveries, af				
	2005	**2006**	**2007**	**2008**	**2009**
Grassland WD	154,456	191,821	162,907	150,284	134,287
Los Banos WA	3,542	21,798	24,171	18,255	19,025
North Grasslands WA	8,008	22,191	24,540	21,550	18,984
San Luis NWR	14,808	48,364	55,466	53,039	56,958
Volta WMA	47,057	11,164	13,129	10,501	10,896
Total SJR	228,863	296,273	281,065	254,341	241,125

Table SJR-10 South of Delta Central Valley Project and State Water Project Deliveries (Percentage of Contract Amounts)

Year	Ag	Urban	Wildlife	SWP
1998	100	100	0	100
1999	70	95	0	100
2000	65	90	0	90
2001	49	77	100	39
2002	70	77	100	70
2003	75	100	100	90
2004	70	95	100	65
2005	85	100	100	90
2006	100	100	100	100
2007	50	75	100	60
2008	40	75	100	35
2009	10	60	100	40
2010	45	75	100	50

Table SJR-11 Drinking Water Systems in the San Joaquin River Hydrologic Region

Water System Size by Population	No. of Community Systems	% of Community Systems in Region	Population Served	% of Population Served
Large (> 10,000)	29	7	1,501,338	82
Medium (3301-10,000)	35	8	186,402	10
Small (500-3300)	72	16	96,257	5
Very Small (< 500)	297	68	44,133	2
CWS that Primarily Provide Wholesale Water	5	1		
Total	438	100	1,828,130	

Table SJR-13 Summary of Community Drinking Water Systems in the San Joaquin River Hydrologic Region that Rely on One or More Contaminated Groundwater Well That Exceeds a Primary Drinking Water Standard

Community Drinking Water Systems and Groundwater Wells Grouped by Water System Population	No. of Affected Community Drinking Water Systems	No. of Affected Community Drinking Water Wells
Small System ≤ 3,300	80	119
Medium System 3,301-10,000	8	18
Large System ≥ 10,000	16	91
Total	104	228

Source: Water Boards 2012 Draft Report on "Communities that Rely on Contaminated Groundwater"

Table SJR-14 Summary of Contaminants Affecting Community Drinking Water Systems in the San Joaquin River Hydrologic Region

Principal Contaminant (PC)	Community Drinking Water Systems where PC exceeds the Primary MCL	No. of Community Drinking Water Wells where PC exceeds the Primary MCL
Arsenic	58	120
Gross alpha particle activity	38	76
Uranium	23	40
Nitrate	17	26
1,2-Dibromo-3-chloropropane (DBCP)	12	28
Tetrachloroethylene (PCE)	4	4

Source: Water Boards 2012 Draft Report on "Communities that Rely on Contaminated Groundwater"

Notes:

Only the 6 most prevalent contaminants are shown.

Wells with multiple contaminants:

40 wells are affected by Gross alpha particle activity & Uranium

13 wells are affected by Arsenic & Gross alpha particle activity/Uranium

6 wells are affected by Nitrate & Gross alpha particle activity/Uranium

6 wells are affected by both Arsenic & Nitrate

Table SJR-15 San Joaquin River Hydrologic Region Exposures within the 100-Year and 500-Year Floodplains

Segment Exposed	1% (100-yr) Floodplain	0.2% (500-yr) Floodplain
Population, % total exposed	157,100, 9%	535,300, 31%
Structure and Content Value	$11.3 billion	$39.6 billion
Crop Value	$1.4 billion	$1.9 billion
Tribal Lands (acres)	3	3
Essential Facilities (count)	93	298
High Potential-Loss Facilities (count)	92	134
Lifeline Utilities (count)	12	29
Transportation Facilities (count)	646	901
Department of Defense Facilities (count)	2	2
State and Federal Threatened, Endangered, Listed ,and Rare Plants [a]	130	131
State and Federal Threatened, Endangered, Listed ,and Rare Animals [a]	131	131

Source: SFMP California's Flood Future Report

Note:
a Many Sensitive Species have multiple occurrences throughout the state and some have very large geographic footprints that may overlap more than one analysis region. As a result, a single Sensitive Species could be counted in more than one analysis region. Because of this the reported statewide totals will be less than the sum of the individual analyses regions.

Table SJR-16 Selection of Organizations in the San Joaquin River Hydrologic Region Involved in Water Governance

Entity	Role/Responsibilities	Federal, State, or Local
Madera Canal (CVP)	Provide regional water supply	Federal
US Bureau of Reclamation	Operation of Friant Dam, Delta Mendota and San Luis canals	Federal
US Army Corps of Engineers	Operation of New Hogan, Burns, Owens, Buchanon, Bear, Mariposa, and Hidden dams	Federal
State Water Project	Interregional water supply	State
Madera Irrigation District	Deliver CVP supplies from Friant Dam, as well as local supplies	Local
Chowchilla Water District	Deliver CVP supplies from Friant Dam, as well as local supplies	Local
Cities of Madera, Merced, Turlock, Modesto & Stockton	Municipal water supplies	Local
Merced Irrigation District	Deliver Merced River supplies	Local
Turlock Irrigation District	Deliver Tuolumne River supplies	Local
Modesto Irrigation District	Deliver Tuolumne River supplies	Local
Friant Water Authority	Madera Canal CVP deliveries	Local
San Luis & Delta Mendota Water Authority	Maintain and operate DMC	Local
Patterson Water District	Deliver San Joaquin River supplies	Local
West Stanislaus Irrigation District	Deliver San Joaquin River supplies	Local
Grasslands Water District	Distribute CVP supplies to area wildlife refuges	Local
San Joaquin River Exchange Contractors	Deliver San Joaquin River supplies	Local
Oakdale Irrigation District	Deliver Stanislaus River supplies	Local
South San Joaquin Irrigation District	Deliver Stanislaus River supplies	Local
South Delta WA	Charged with protecting the in-channel water supply for Delta-area farmers	Local
Central Delta WA	Charged with protecting the in-channel water supply for Delta-area farmers	Local
North San Joaquin WCD	Deliver Mokelumne River supplies	Local
Amador WA	Deliver Mokelumne River municipal supplies, as well as provide wastewater services	Local
Calaveras Co. WD	Deliver Mokelumne, Stanislaus, and Calaveras rivers municipal supplies, as well as provide wastewater services	Local
Tuolumne Utilities District	Deliver Tuolumne River supplies, as well as provide wastewater services	Local

Table SJR-17 Integrated Regional Water Management Grants Awarded in the San Joaquin River Hydrologic Region

Grant Program	Applicant/IRWM Group	Award
Prop. 50 Planning	San Luis and Delta Mendota Water Authority/Westside San Joaquin	$25,000,000
	Contra Costa Water District/East Contra Costa Co	$12,500,000
Prop. 84 Planning	CABY - Regional Water Management Group	$647,593
	Contra Costa Water District/East Contra Costa Co	$449,843
	Merced Area Groundwater Pool Interests (MAGPI)	$719,010
	Northeastern San Joaquin County Groundwater Banking Authority/Eastern San Joaquin	$545,925
	Regional Water Authority/American River Basin	$403,848
	Tuolumne Utilities District/Tuolumne - Stanislaus	$636,380
	Upper Mokelumne River Watershed Authority/Mokelumne/Amador/Calaveras	$250,909
Prop. 84 Implementation	East Contra Costa County	$1,775,000
	Madera	$9,413,947
	American River Basin	$1,895,806
	Mokelumne/Amador/Calaveras	$2,298,000
Prop. 1E SWFM	Contra Costa Water District/East Contra Costa Co.	$10,000,000
	Contra Costa Flood Control & Water Conservation District/East Contra Costa Co.	$2,000,000
	City of Antioch/East Contra Costa Co.	$2,997,300
	Total	$71,533,561

Table SJR-18 Strategies of Integrated Regional Water Management Efforts in the San Joaquin River Hydrologic Region

Plan strategies	Westside IRWMP	American River Basin IRWMP	Cosumnes, American, Bear, Yuba Watershed IRWMP	Mokelumne/ Amador/ Calaveras IRWMP	Madera County IRWMP	Eastern San Joaquin IRWMP	East Contra Costa Co [a]
	May 2007	June 2006	Dec 2006	Nov 2006	Apr 2008	Jul 2007	Jul 2007
Agricultural and urban water management planning and water use efficiency			X		X	X	
Climate change			X				
Conjunctive management and groundwater storage		X		X	X	X	X
Conservation				X			
Conveyance			X			X	
Desalination							X
Economic incentives (Loans, grants, and water pricing)						X	
Environmental restoration and preservation; habitat protection and improvement	X	X	X	X	X	X	X
Flood management	X	X	X	X			X
Groundwater management	X	X	X	X		X	X
Groundwater monitoring					X	X	
Groundwater quality protection					X	X	
Imported water				X	X	X	X
Interregional cooperation					X		
Land use planning and coordination		X	X	X	X	X	X
Levee and channel restoration					X		
Matching water quality to water use						X	
Pollution monitoring, control, and prevention		X	X	X		X	X
Recharge areas protection					X	X	

Plan strategies	Westside IRWMP	American River Basin IRWMP	Cosumnes, American, Bear, Yuba Watershed IRWMP	Mokelumne/ Amador/ Calaveras IRWMP	Madera County IRWMP	Eastern San Joaquin IRWMP	East Contra Costa Co [a]
	May 2007	**June 2006**	**Dec 2006**	**Nov 2006**	**Apr 2008**	**Jul 2007**	**Jul 2007**
Recreation and public access	X	X	X			X	X
Reduce groundwater pumping and overdraft; increase surface water supplies			X	X	X	X	
Reduction of invasive species					X		
Resource mapping			X				
Storm water capture and management	X	X		X	X		X
System reoperation						X	
Water transfer and exchange					X	X	X
Water and wastewater treatment		X		X	X	X	X
Water conservation and recycling	X	X	X	X	X	X	X
Water quality protection and improvement	X	X	X	X			X
Water supply reliability	X	X	X	X	X	X	X
Watershed management and planning		X		X	X	X	X
Wetland enhancement and creation	X	X	X				X

[a] functionally equivalent plan

Photo SJR-1 Mine Waste

Improperly graded mine waste

Calfed Mine after grading

Figure SJR-2 Median Household Income (MHI) for Disadvantaged Communities (DACs) within the San Joaquin River Hydrologic Region Cities

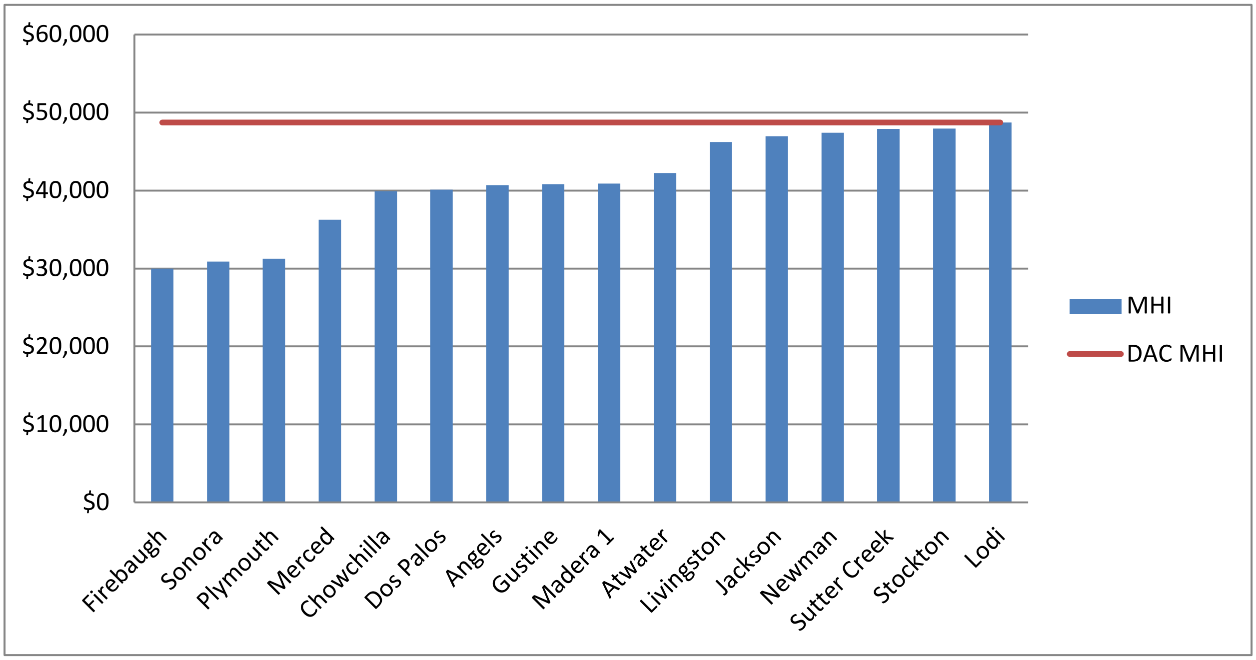


Figure SJR-3 Median Household Income (MHI) for Disadvantaged Communities (DACs) within the San Joaquin River Hydrologic Region: Poorest 20 Census Designated Places

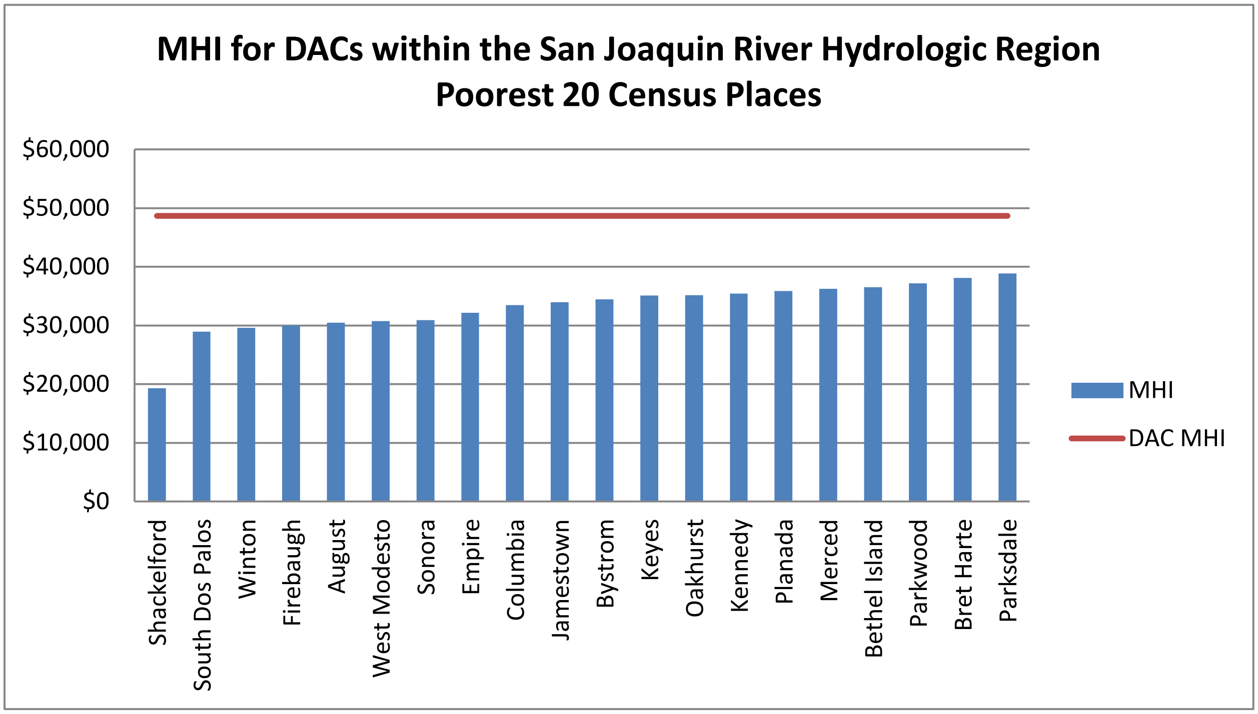


Figure SJR-4 San Joaquin River Hydrologic Region Gross Agricultural Value for 2005-2010, in Millions of Dollars

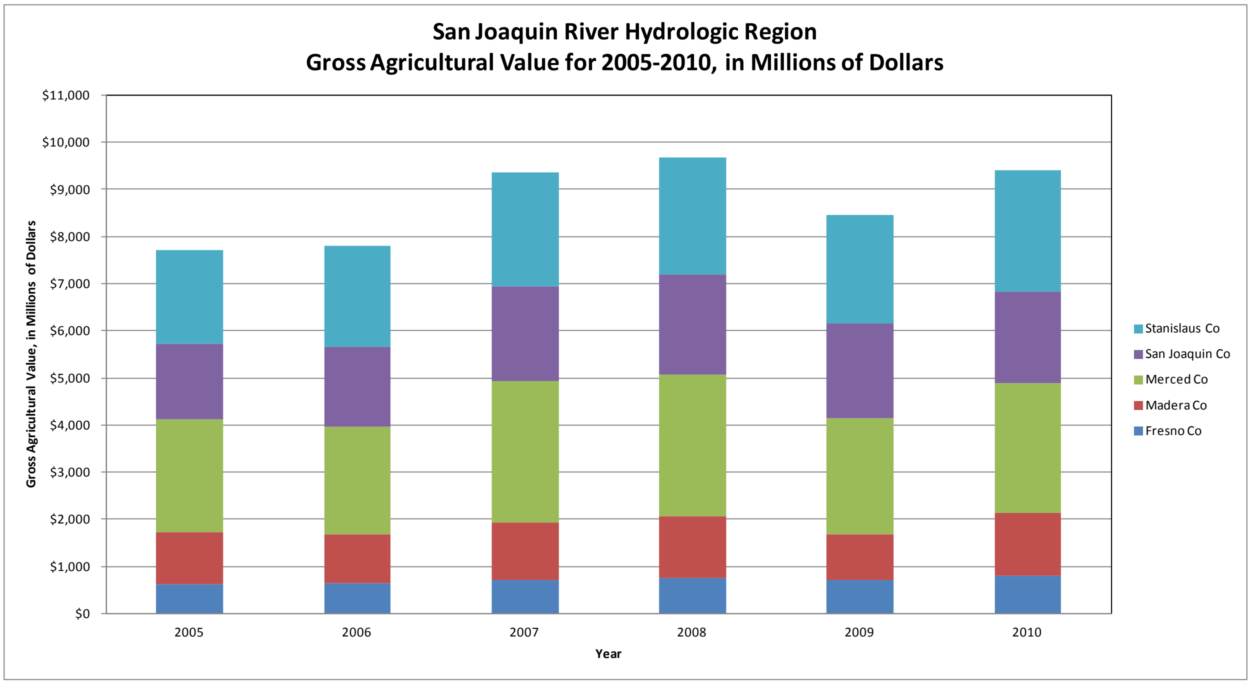
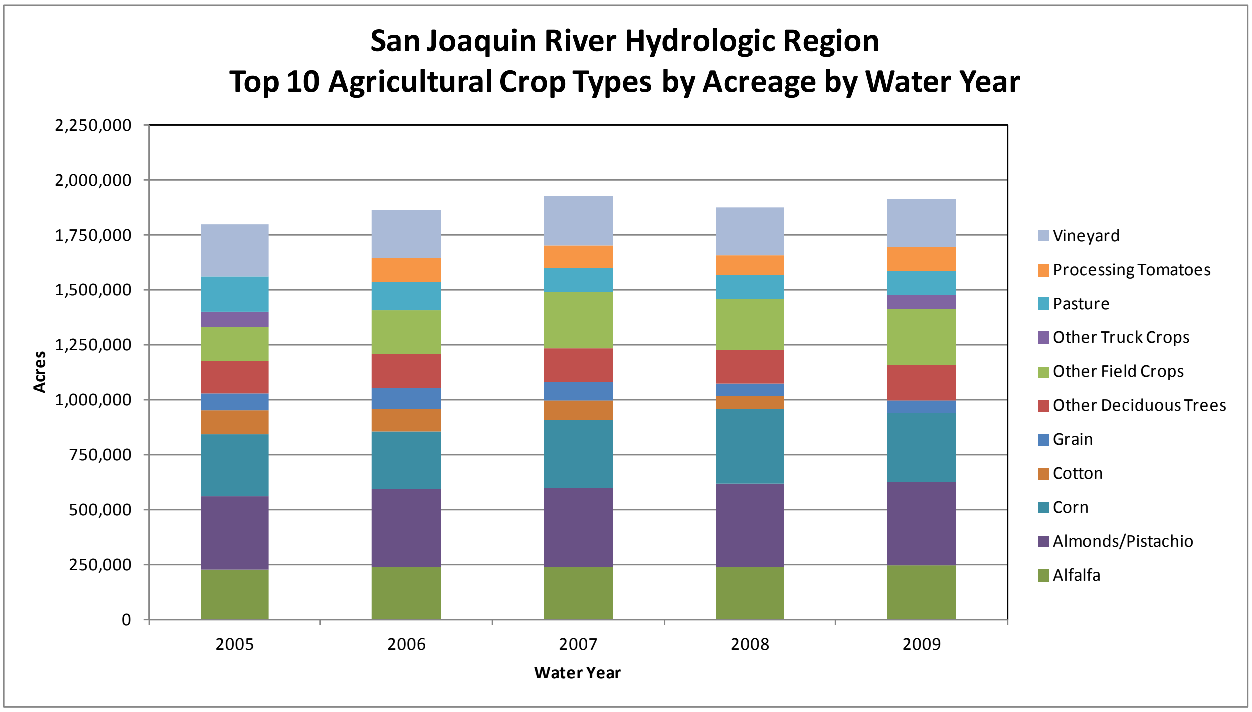


Figure SJR-5 **Top 10 Crop Types by Acreage for the San Joaquin River Region for 2005-2009**



Notes: *Other Field Crops*: Flax, hops, grain sorghum, sudan, castor beans, miscellaneous fields, sunflowers, hybrid sorghum/sudan, millet, and sugar cane. *Other Truck Crops*: Artichokes, asparagus, beans (green), carrots, celery, lettuce, peas, spinach, flowers nursery and tree farms, bush berries, strawberries, peppers, broccoli, cabbage, cauliflower, and Brussels sprouts. *Other Deciduous Trees*: Apples, apricots, cherries, peaches, nectarines, pears, plums, prunes, figs, walnuts, and miscellaneous deciduous

Figure SJR-6 San Joaquin River Hydrologic Region Water Supplies for Water Years 2005-2010

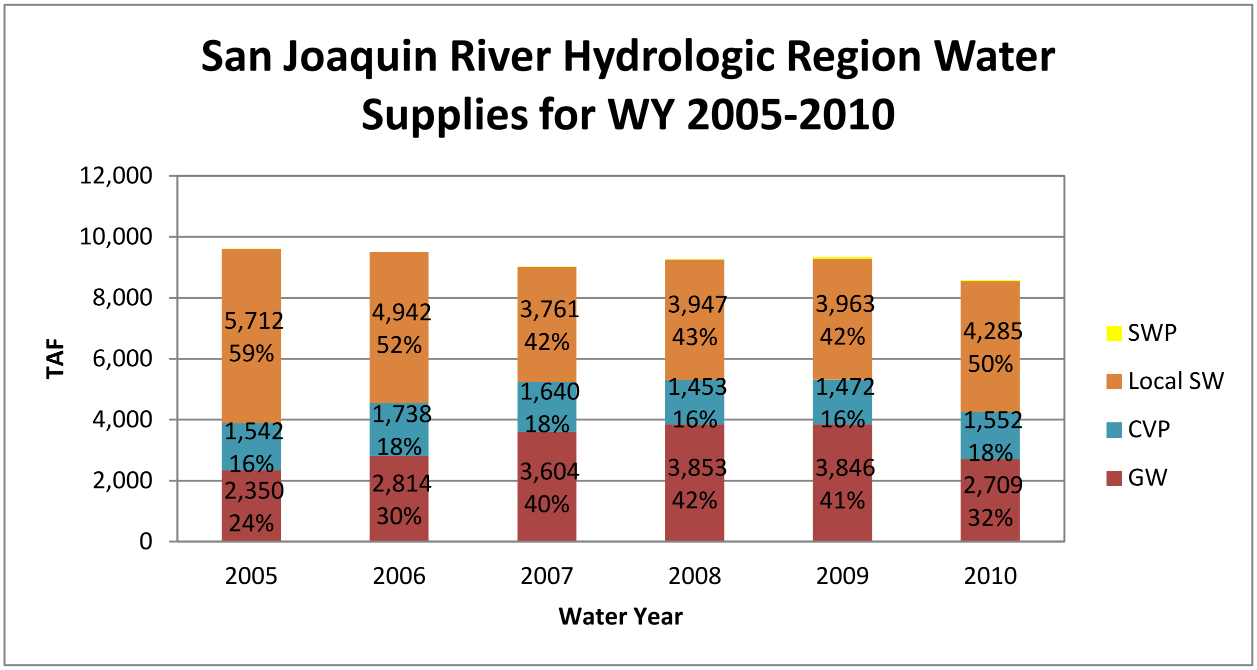
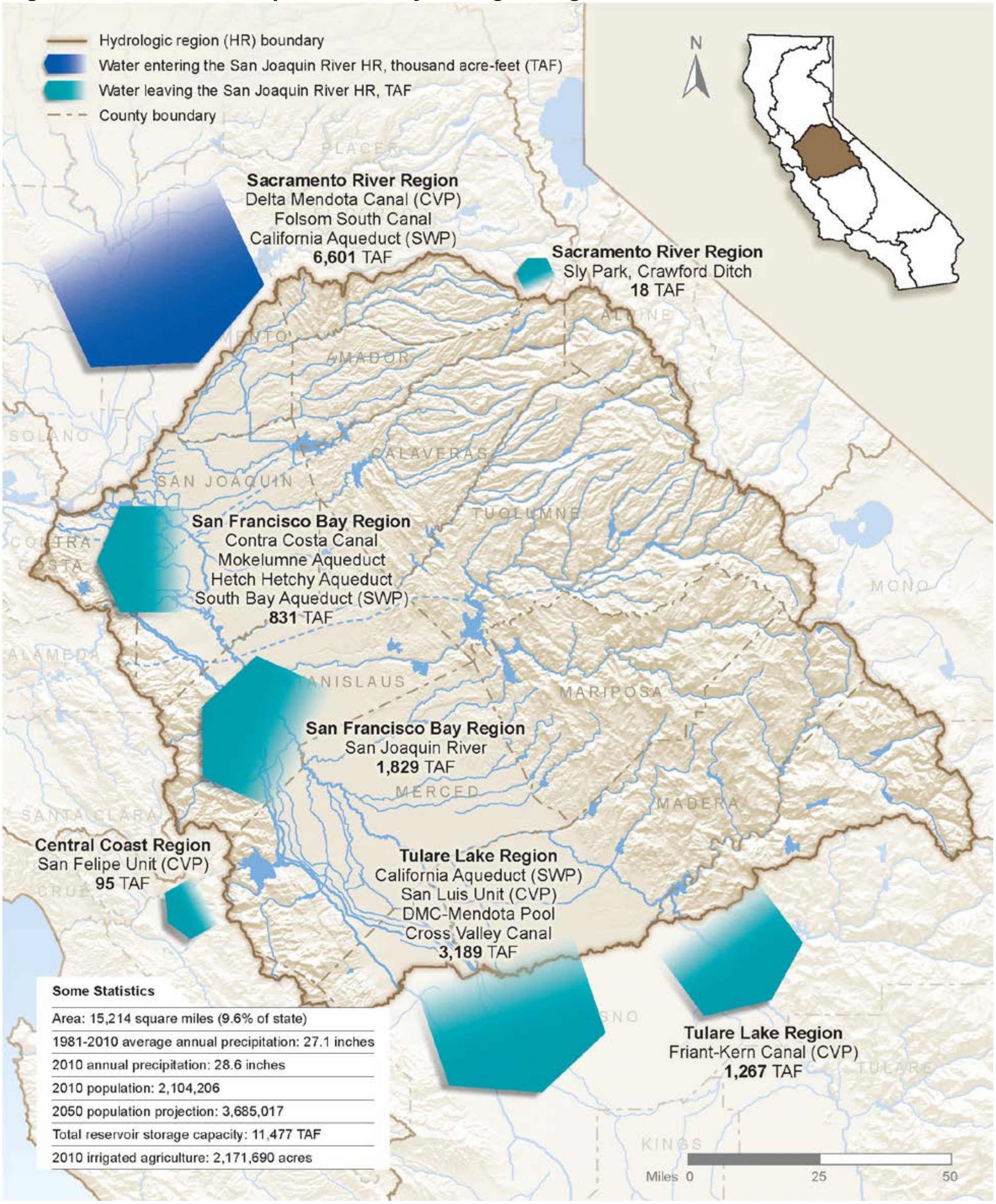


Figure SJR-7 San Joaquin River Hydrologic Region Inflows and Outflows in 2010



Some Statistics

Area: 15,214 square miles (9.6% of state)
1981-2010 average annual precipitation: 27.1 inches
2010 annual precipitation: 28.6 inches
2010 population: 2,104,206
2050 population projection: 3,685,017
Total reservoir storage capacity: 11,477 TAF
2010 irrigated agriculture: 2,171,690 acres

Source: Department of Water Resources

Figure SJR-8 **South of Delta Central Valley Project and State Water Project Annual Deliveries (Percentage of Contracted Amount)**

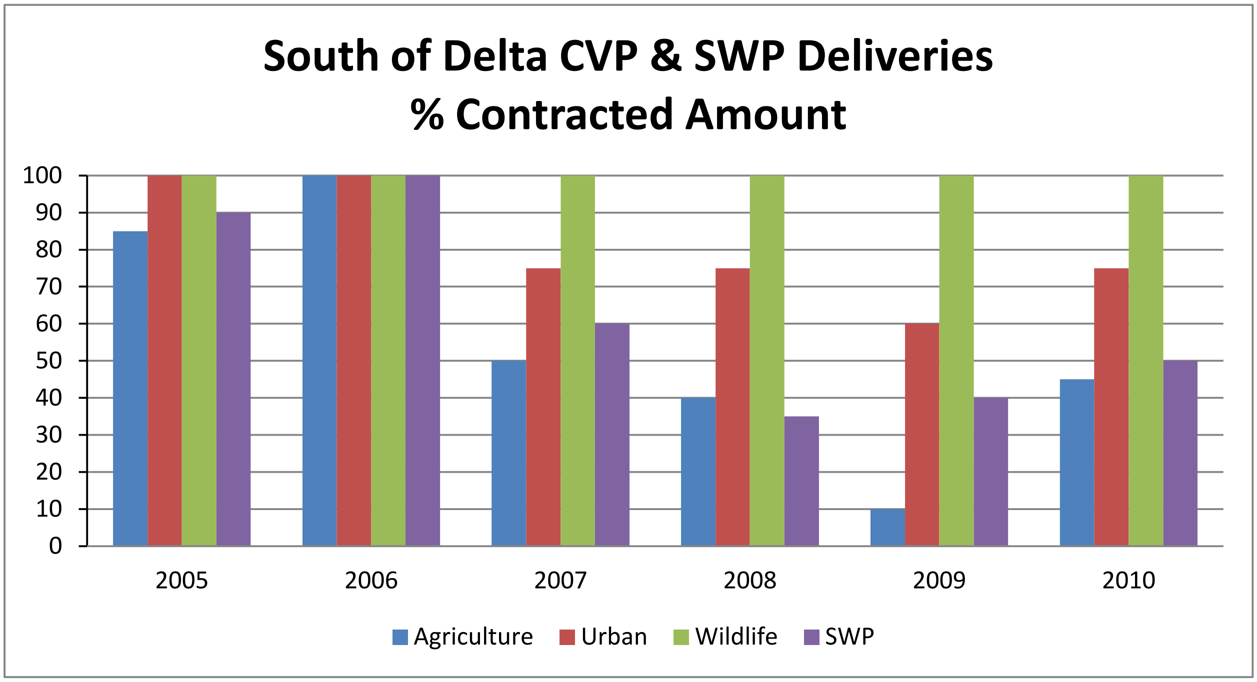


Figure SJR-10 Salt Slough and Mud Slough (DRAFT)

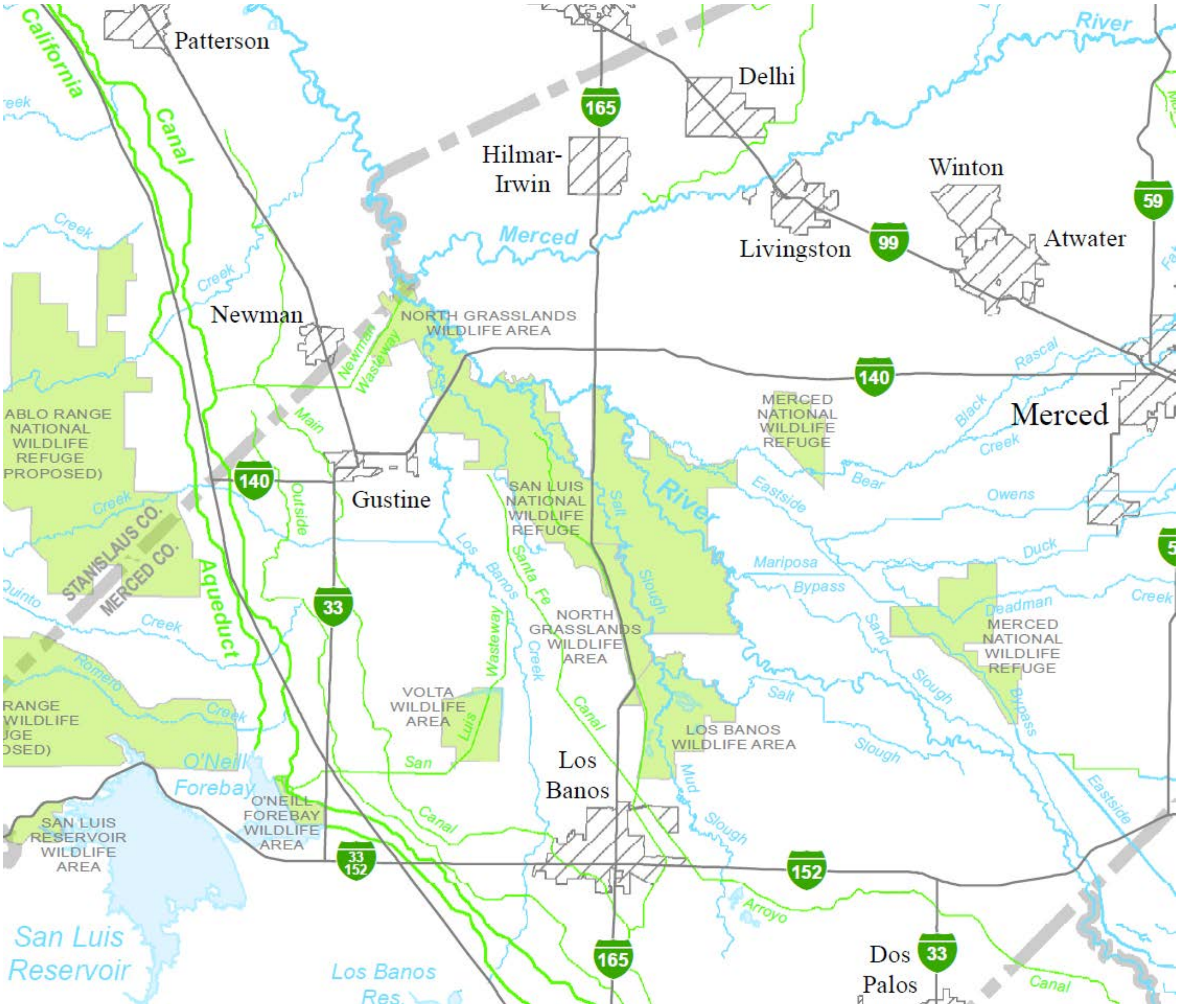
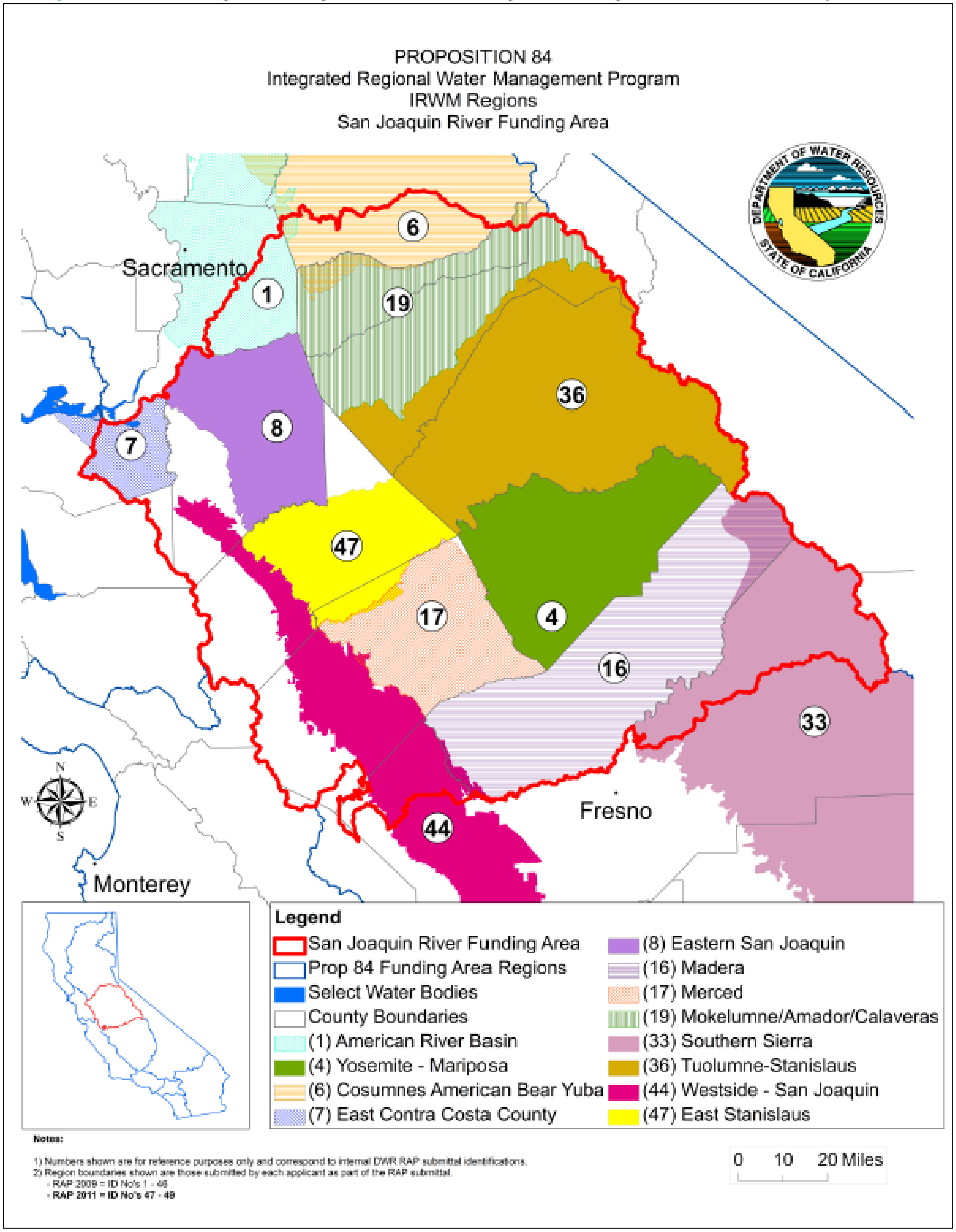


Figure SJR-11 Integrated Regional Water Management Regions in the San Joaquin River



http://www.water.ca.gov/irwm/grants/docs/FundingAreaContacts/SanJoaquinRiverFA2012_1016.pdf

Figure SJR-12 Change in Urban Water Demand

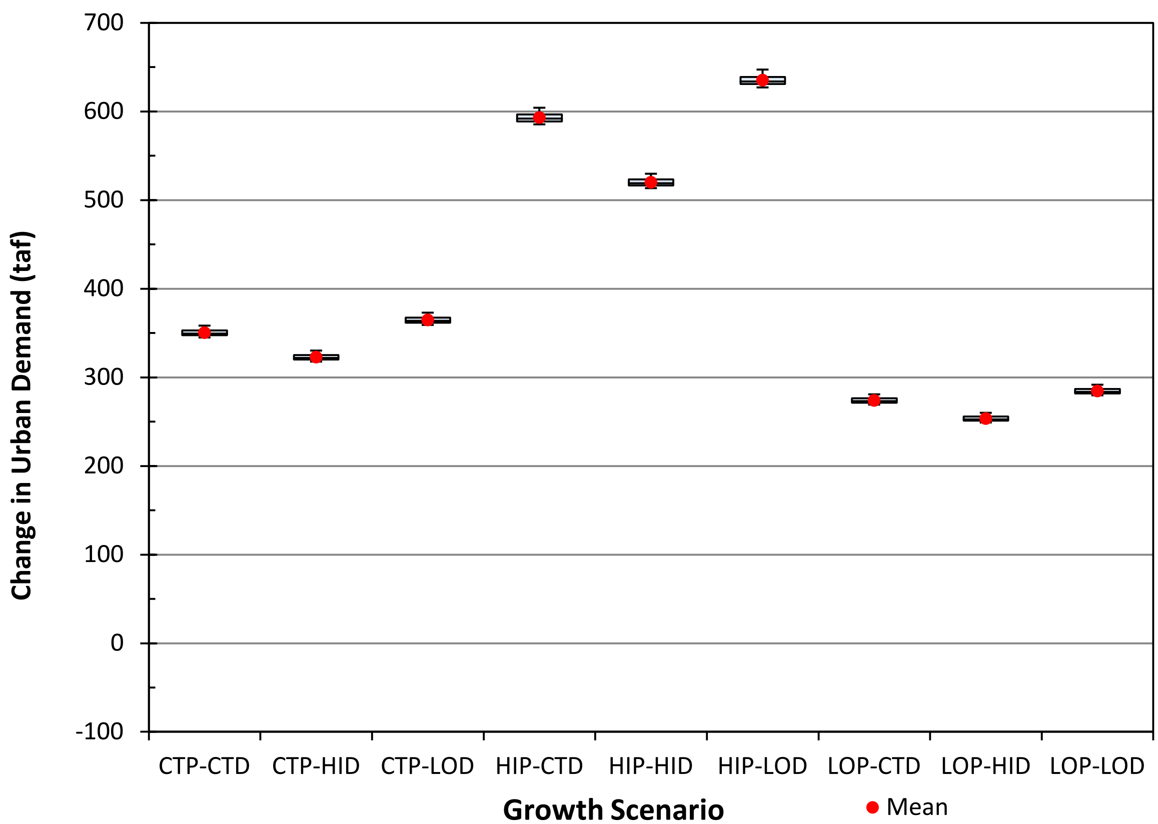


Figure SJR-13 Change in Agricultural Water Demand

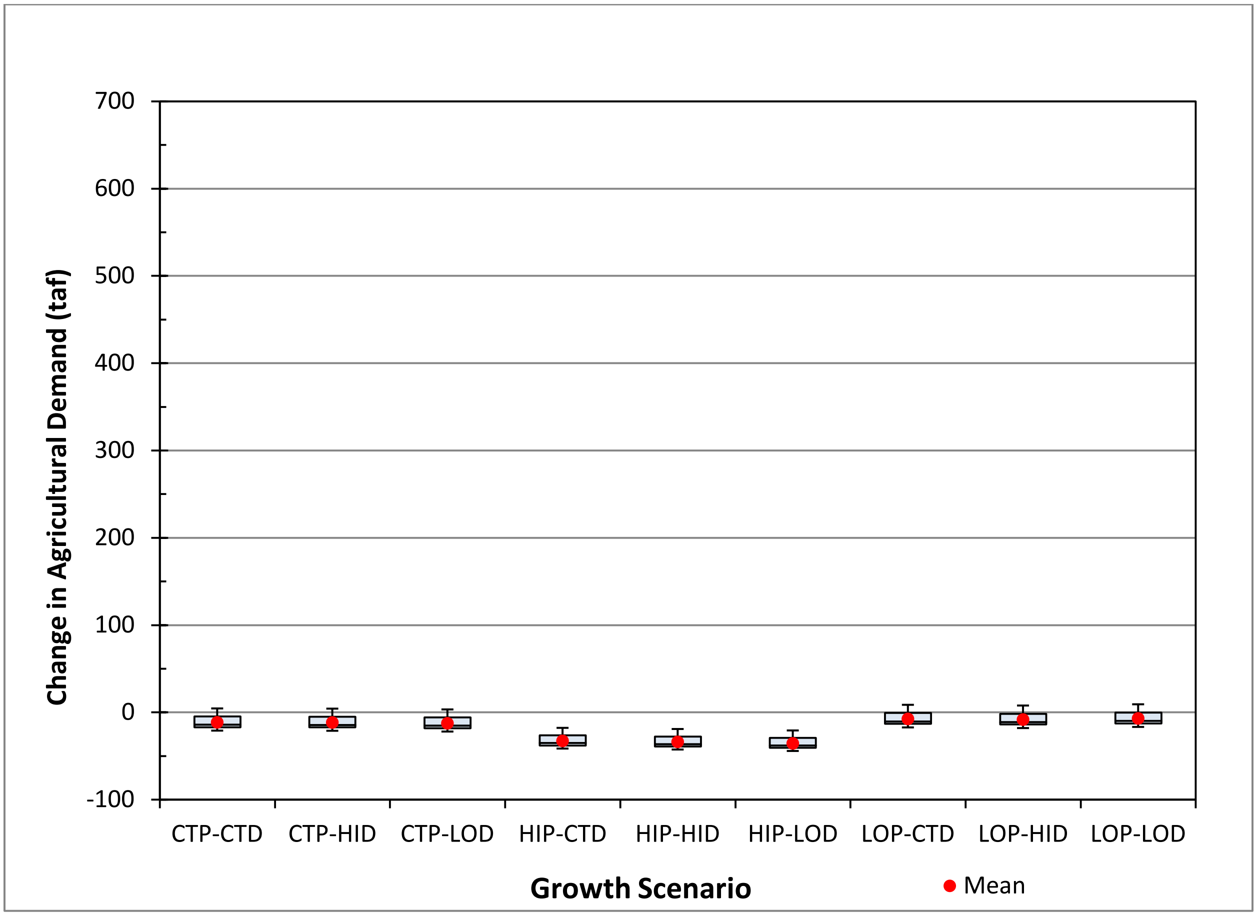
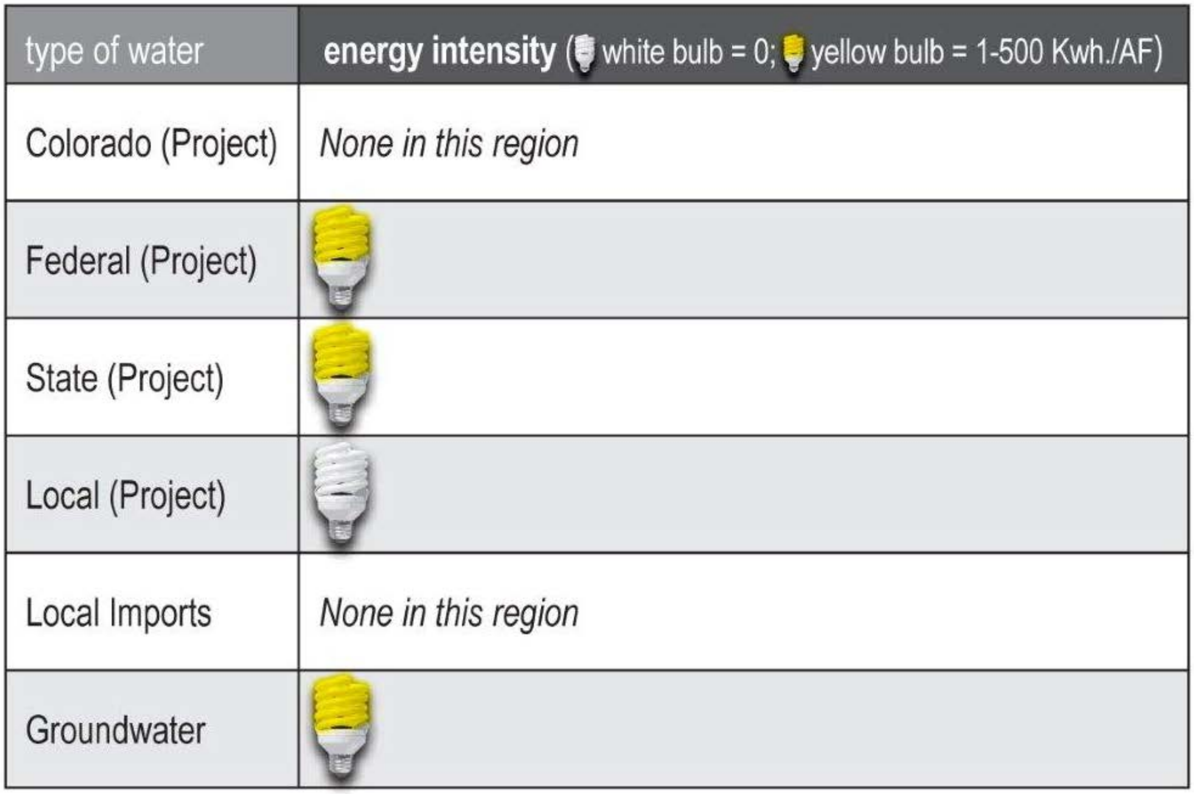


Figure SJR-14 Energy Intensity of Raw Water Extraction and Conveyance in the San Joaquin Hydrologic Region (DRAFT, figure is under development)



type of water	energy intensity (white bulb = 0; yellow bulb = 1-500 Kwh./AF)
Colorado (Project)	*None in this region*
Federal (Project)	
State (Project)	
Local (Project)	
Local Imports	*None in this region*
Groundwater	

* The Western Regional Climate Center (WRCC) has temperature and precipitation data for the past century . Through an analysis of National Weather Service Cooperative Station and PRISM Climate Group gridded data, scientists from the Western Regional Climate Center have identified 11 distinct regions across the state for which stations located within a region vary with one another in a similar fashion. These 11 climate regions are used when describing climate trends within the state (Abatzoglou, J.T., et al, 2009). DWR's hydrologic regions do not correspond directly to WRCC's climate regions. A particular hydrologic may overlap more than one climate region, and hence have different climate trends in different areas. For the purpose of this regional report, climate trends of overlapped climate regions are considered to be relevant trends for respective portions of the overlapping hydrologic region.